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UNITED STATES NAVAL INSTITUTE PROCEEDINGS

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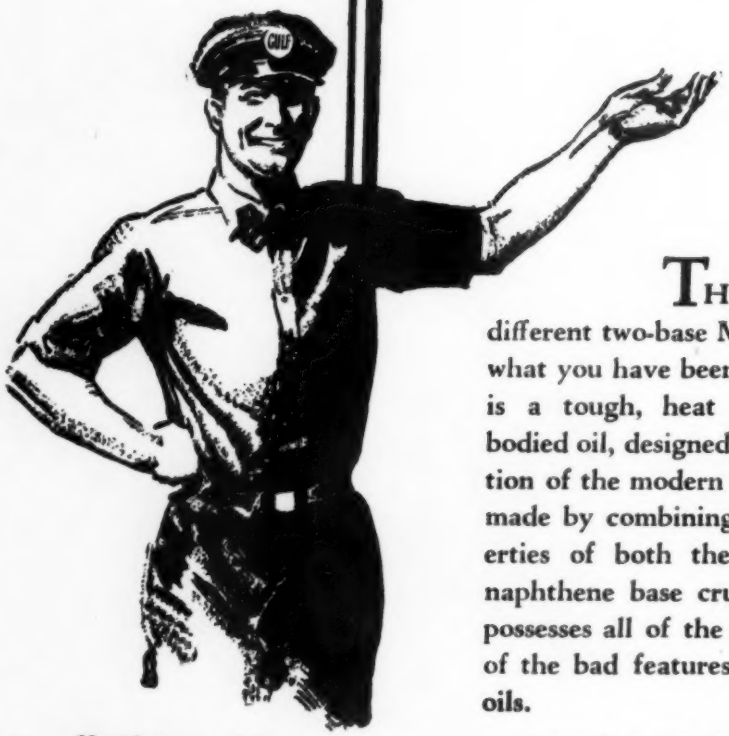

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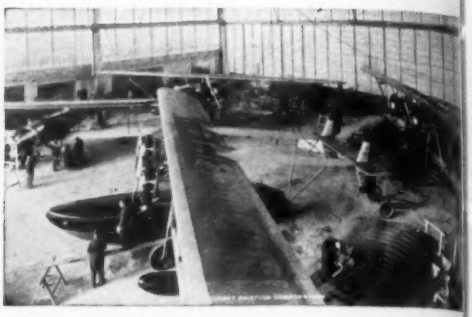

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SIKORSKY AMPHIBION

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FORT SAN FELIPE

This photograph shows the original flagpole with Dewey tablet on wall to its right.

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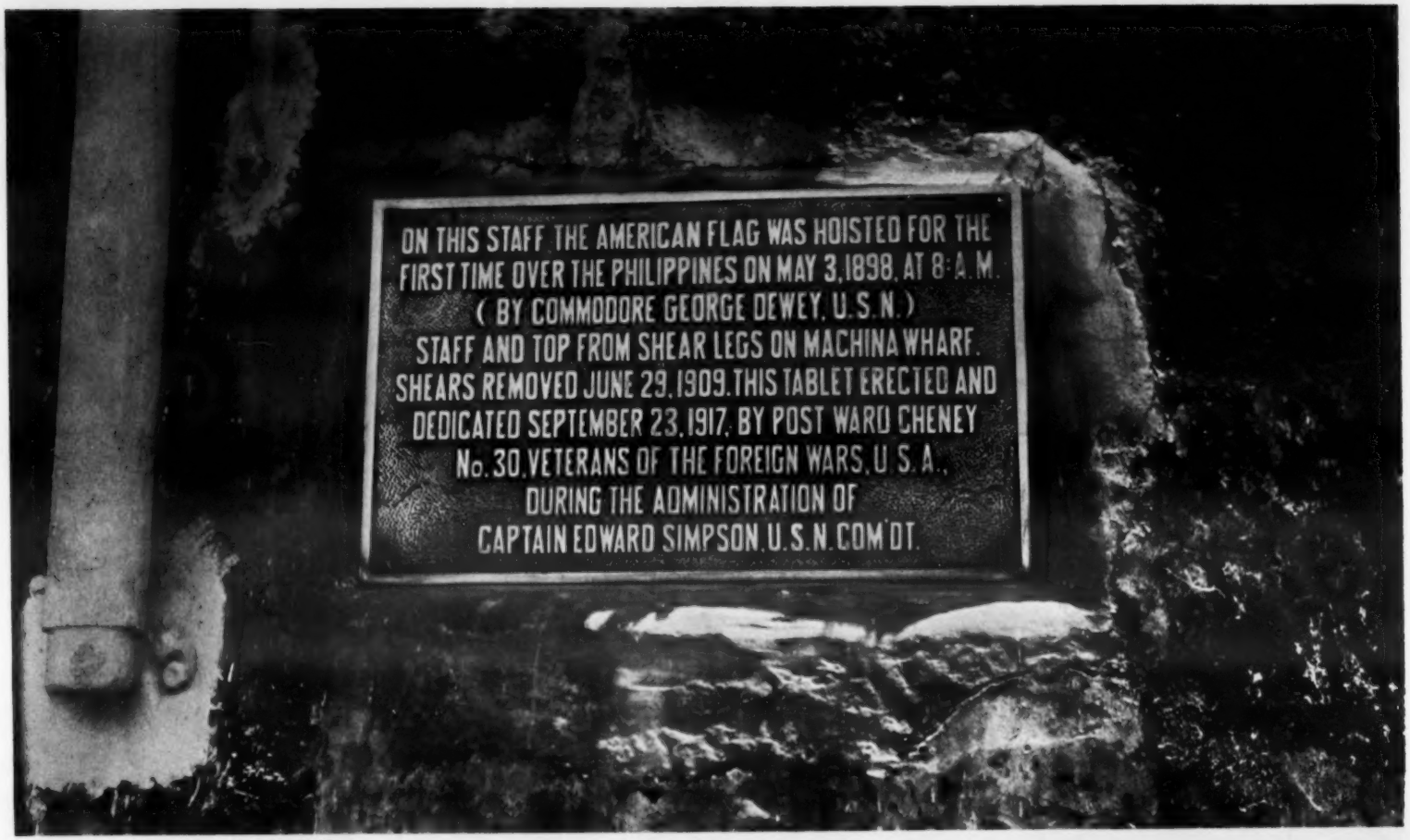
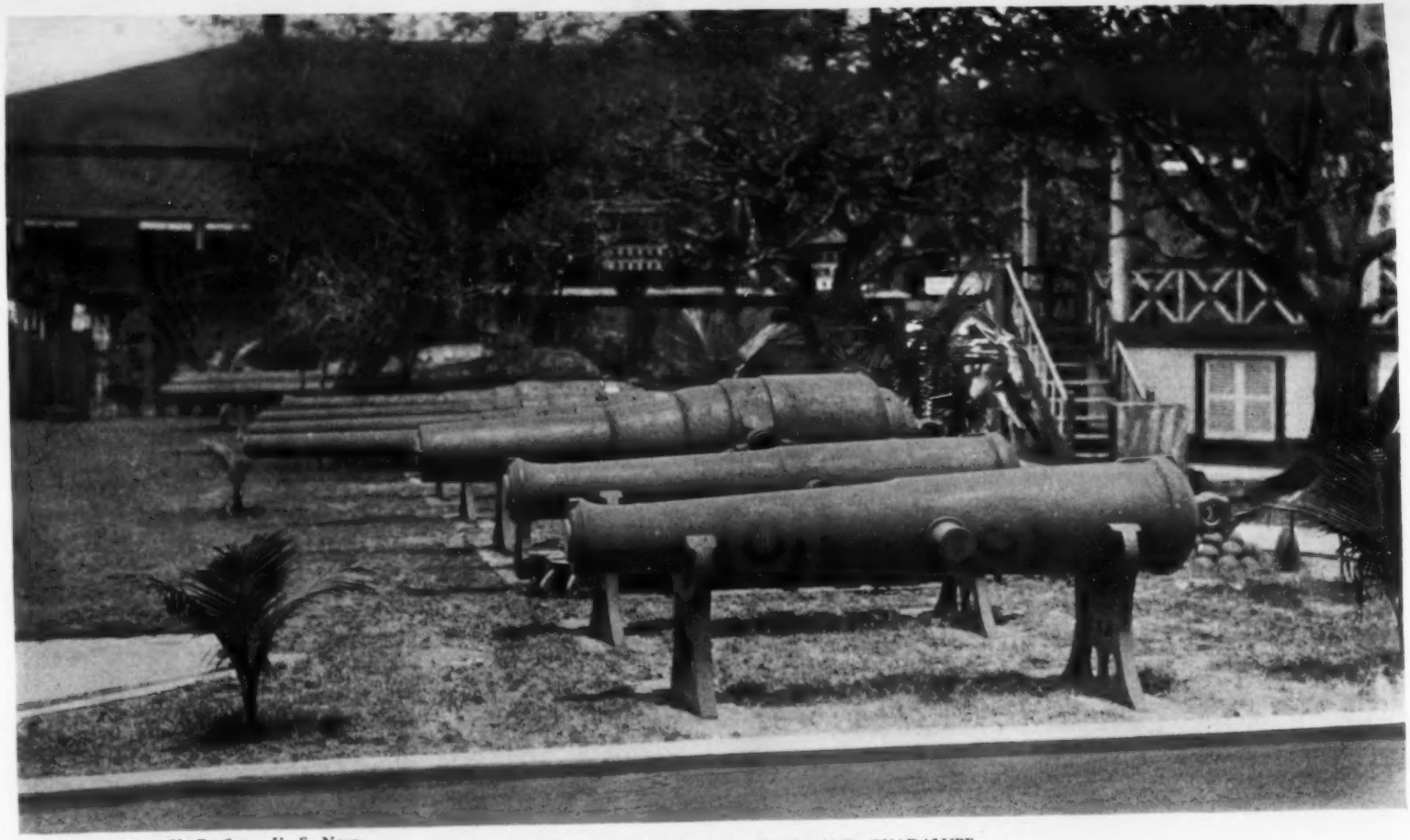

ON THIS STAFF THE AMERICAN FLAG WAS HOISTED FOR THE
FIRST TIME OVER THE PHILIPPINES ON MAY 3, 1898, AT 8 A. M.
(BY COMMODORE GEORGE DEWEY, U. S. N.)
STAFF AND TOP FROM SHEAR LEGS ON MACHINA WHARF.
SHEARS REMOVED JUNE 29, 1909. THIS TABLET ERECTED AND
DEDICATED SEPTEMBER 23, 1917, BY POST WARD CHENEY
No. 30, VETERANS OF THE FOREIGN WARS, U. S. A.,
DURING THE ADMINISTRATION OF
CAPTAIN EDWARD SIMPSON, U. S. N. COM'DT.

Courtesy Lieutenant H. F. Cope, U. S. Navy

DEWEY TABLET ON THE WALL OF FORT SAN FELIPE



Courtesy Lieutenant H. F. Cope, U. S. Navy

GUNS TAKEN FROM FORTS SAN FELIPE AND GUADALUPE

The largest one in the foreground is an 8-inch muzzle-loader taken from Fort Gaudalupe.

U.S. DEPT. OF AGRICULTURE

Courtesy Lieutenant H. F. Cope, U. S. Navy

FORT SAN FELIPE

This landward side of the fort was used temporarily as a naval magazine immediately after the occupation by American forces.

This landward side of the fort was used temporarily as a naval magazine immediately after the occupation by American forces.

Courtesy Lieutenant H. F. Cope, U. S. Navy

A VIEW OF THE FORMER CHAPEL ACROSS FROM THE COMANDANCIA
This is now building No. 50 of the Naval Station, Cavite.

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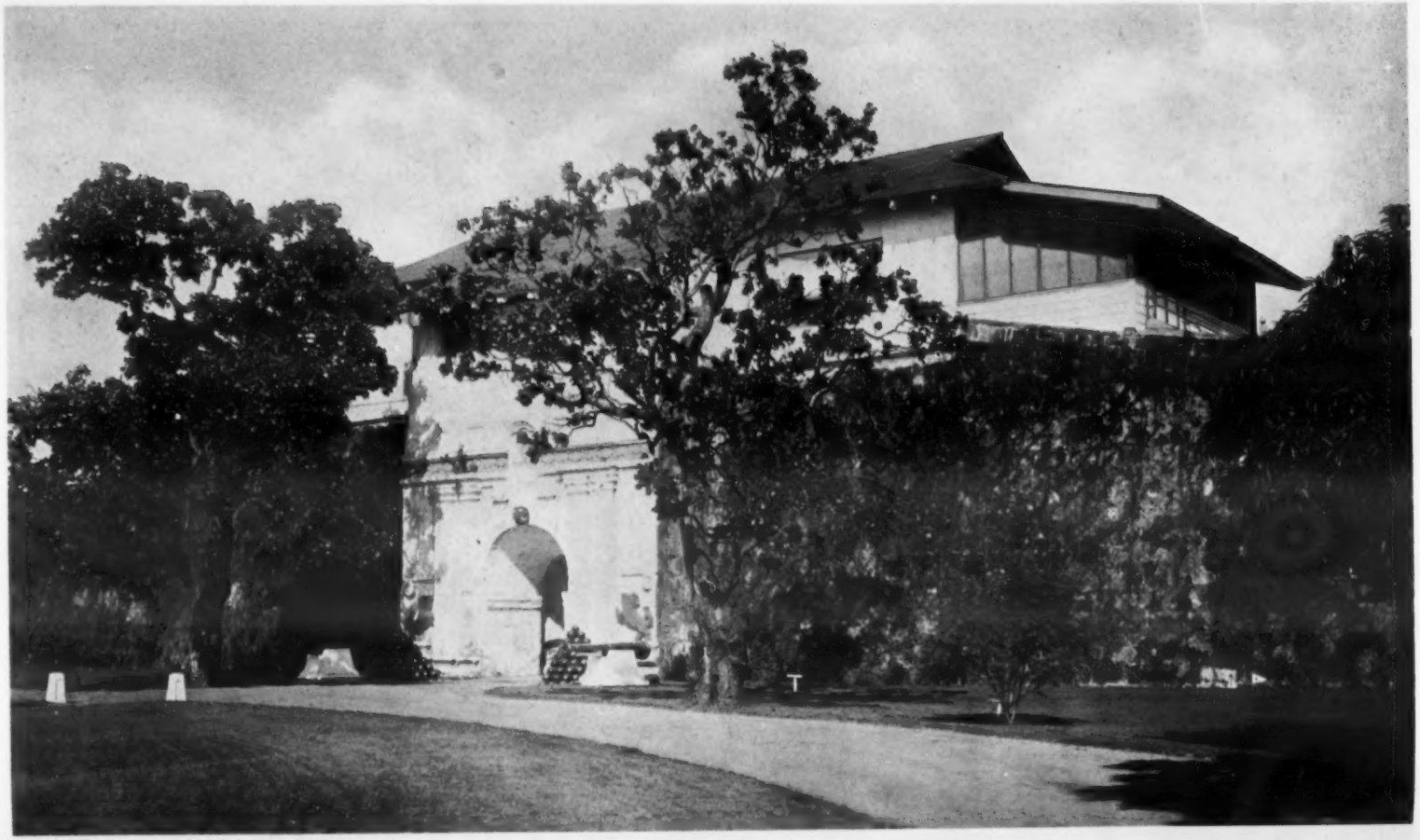


Courtesy Lieutenant H. F. Cope, U. S. Navy

A VIEW OF FORT SAN FELIPE FROM THE ATHLETIC FIELD

Courtesy Lieutenant H. F. Cope, U. S. Navy

A VIEW OF FORT SAN FELIPE FROM THE ATHLETIC FIELD

Courtesy Lieutenant H. F. Cope, U. S. Navy

FORT SAN FELIPE

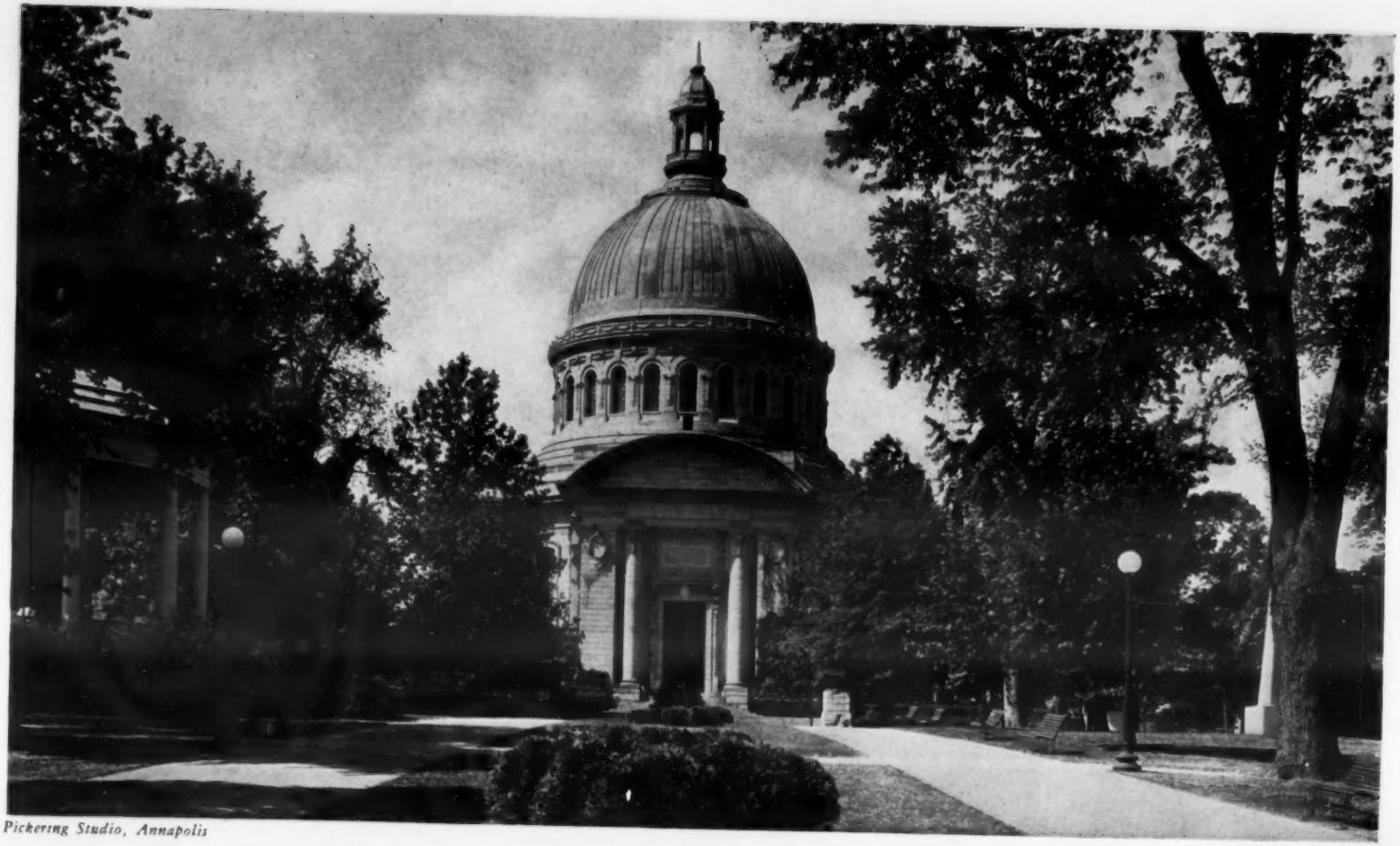
This view shows the main gate to the fort, with the house of the captain of yard atop the gate.

UNIV. OF MICH.

Courtesy Lieutenant H. F. Cope, U. S. Navy

A CLOSE-UP VIEW OF THE GATE OF FORT SAN FELIPE

A CLOSE-UP VIEW OF THE CAVE OF [illegible]



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THE CHAPEL, U. S. NAVAL ACADEMY

The photograph shows the dome of the chapel with its new copper covering placed there the past winter and spring.

UNITED STATES
NAVAL INSTITUTE
PROCEEDINGS

Vol. No. 56, No. 9 SEPTEMBER, 1930 *Whole No. 331*

The Exercise *of* Command Afloat

By CAPTAIN C. S. FREEMAN, *U. S. Navy*

My son Hannibal will be a great general, because of all my soldiers he best knows how to obey.—HAMILCAR.

SOURCE MATERIAL AND FUNDAMENTALS

IN SEEKING material for a discussion of command, one is struck with the absence of literature on the subject deriving from the pens of the great military commanders and leaders of history. There have been successful military commanders who have been writers of note; who have, for instance, been excellent historians, and it is not uncommon to find able discussions by the best of the world's military leaders on the principles of war, on certain tactical theories, on many of the abstract features that go to make up the profession of arms. Rarely, however, does one find in such writings a direct reference to the actual technique of command. Certainly there is no standard work on the principles of command written by any one of the outstanding geniuses whose lives we study and whose exploits we analyze with a view to finding out what made them what they were. It is as if the exercise of the art of command was an essential manifestation of their personality, recognizable, to be sure, by themselves and by others, but irreducible to the terms by means of which knowledge is transmitted from the comprehension of one mind to the comprehension of another. All great art partakes somewhat of this intangible characteristic, but whereas the great painter may expound with clearness the method of handling colors and brush, or the great writer, the method of marshaling ideas, the leader of men, in attempting to communicate his methods of command, is confronted with a myriad of variables, the setting down of which transcends human ability.

Just, however, as mathematicians, although finding it difficult to devise or solve practical problems of the fourth dimension, are able, by means of theoretical concepts, to place before us in an illuminating way certain of the properties of what is neither length nor breadth nor thickness, while in the same category with all three, so students of command, by analysis of those methods of performance which are apparent in the successful operations of great commanders or in the successful attainments of those who have been greatly commanded, may arrive at a comprehension of what to do and what to avoid doing in exercising authority over others. For, after all, that is what successful command resolves itself into in the final analysis—to exercise authority over others properly. And we are using the word "properly" in its basic sense of befitting one's nature, one's qualities—in short, one's self. To exercise authority over others, then, as befits the nature of the commander on the one hand, as befits the nature of the

The photograph shows the dome of the chapel with its new copper covering placed there the past winter and spring.

commanded on the other, is to attain success in the exercise of command.

An officer, in the military or naval sense, is one who holds a position of authority or command. From the moment that one becomes an officer one begins to exercise some of the functions of command. By observation, by reading, by imitation, through training, not infrequently from pure imagination, one derives one's initial conception of what an officer is. In that conception one's first command is given. It reacts on the giver and on the receiver. In the degree of this reaction lies the extent of the difference between the first command and the second, the first exercise of authority and all subsequent exercises of the art of command. Each successive manifestation produces its own peculiar and individual reaction. We are concerned here primarily with the reaction on the giver of the command—the commander. If he be self-willed and opinionated, the reaction is small. If he be open-minded and receptive, the reaction is great. To succeed he must be receptive. In other words, he must not only comprehend the reaction upon himself, which is an act of the inner consciousness, often involuntary, but he must be alert to perceive the reaction upon the commanded. So by a process of trial and error—that is, by practice—he acquires technique. Nor can this process be avoided. In the art of command, practice is essential, as in all the arts. Study helps, reflection helps, judgment helps, but practice perfects. And in this elementary stage the natural leader is as helpless as the ungifted. The former may travel the road to high command faster and proceed along it farther, but initially he must practice the giving of orders and experience over and over again the frictional contact that is represented by the imposition of one's will upon the will of another whether the latter will be acquiescent, indifferent, or opposed. Only in that way can he learn to reduce that friction, can he approach that point where he acquires the power to impose his will on others as he imposes it upon himself; where, in other words, obedience, coöperation, and loyalty are yielded as a matter of course.

It has been pointed out that technique in the art of command is acquired by a process of trial and error. One begins to practice command, one learns from experience, where initially little harm results from defects in theory or practice. Such authority as is exercised derives from the orders or instructions of superiors. In exercising this minor form of command, one is manifesting obedience. Obedience is a form of self-command. It is the placing of one's will at the disposition of a superior; it is the making his will one's own.

In the military or naval profession, improvement in the technique of command is usually followed by advancement in authority. While increase in rank takes on somewhat of an automatic aspect in the military services, especially in the lower grades, it is in reality based on sound and logical premises, the major one of which might be set down very tritely as "practice makes for perfection." Now this acquisition of the technique of command is usually a gradual process. One's path to the exercise of high command is hedged about with restrictions. There are customs and traditions to guide one. There is deliberately imposed training on the part of outside authority. There are stereotypes to follow. Undoubtedly there are those who get off the road, either because they choose to leave it or because their forte lies elsewhere. But the way is clear and the guides are many, until one enters the realm of high command.

High Command in Theory and Practice

High command is the function of enjoining obedience upon others that derives from the authority vested in officers of high rank. An officer of low rank cannot exercise high command, unless he be vested with the authority of high rank. In other words, high rank and high command are correlative. One does not exist without the other and it is liable to lead to error and confusion of thought, if we conceive of high command as the exercise of authority in a special and peculiar manner. Indeed, there are discussions of high command that appear to be based on some such fallacy.

Perhaps the outstanding characteristic of high command is the presence in it of a greater or less degree of absolutism. That is, the orders of high command originate largely in the will of the commander of high rank and do not represent, as it were, the paraphrase of the will of another. We know certainly that such orders are based often on general instructions or broad policies, understood or implied, but nevertheless the re-

sponsibility for their issue is in a much higher degree absolute than is the case in the issue of orders by subordinate commanders, whose performance of duty is hedged about with many more specific and detailed regulations and instructions than pertain to the exercise of high command. One has but to glance at the regulation books of the military services in our own or in foreign countries to note the detail that surrounds the exercise of command by, say, the captain of a ship, and the ever broadening generalities that guide the higher commanders in the exercise of their authority.

Now this freedom from restrictive consideration in the exercise of high command carries with it very grave responsibilities. In the exercise of subordinate command, especially in time of peace, corrective influences are always at work tending to limit the effect of errors in judgment or performance. In the realm of high command, these influences, these checks and balances, are fewer and less effective. Mistakes in high command, errors in its administration, are far-reaching, multitudes are affected, desired results are compromised; in war, battles may be lost or their issues rendered doubtful, and nations may be imperiled, their liberties placed in jeopardy. Naturally, then, the power to exercise high command should be delivered into capable hands, and he who is honored with such a trust should consider no effort too laborious to fit himself for his task.

Officers in the military and naval profession, however, are very human. Carrying on in an atmosphere where readiness of material and preparedness of mind are professional fundamentals, they are a class trained to a higher average of professional attainment than are those pursuing the peaceful professions. It is well known, however, that, until a comparatively recent date, great military leaders were conceived of as men born with a genius for command and it was held quite unquestioningly that war leadership could be learned only in the presence of the enemy.

It was the results which flowed from a study principally of the Napoleonic campaign by officers of the Prussian Army after Prussia's humiliation at Jena in 1806 that effectually shook this fallacy from the minds, first, of the French militarists (for it appeared doubtful whether Austria really comprehended the underlying causes of the 1866 debacle) and gradually from the minds of all earnest students of the "dreadful and impassioned drama" of war. Without question, many officers in the past had perceived the need for a study of the art of command, especially of high command. Undoubtedly many individuals, abandoning the task of attempting to influence others to study the art of command, had set themselves resolutely to learn all that history and biography had to teach of this essential military accomplishment. Others, without a very clear realization of the goal toward which their efforts were directed, sensed the value to be derived from a study of what others had attempted or accomplished in the waging of war and hence absorbed, in the pursuit of this interest, correct theories of the art of command, which later they were enabled to put in practice with the effect of inspiration. Napoleon himself not improbably falls in this class. Cæsar certainly was deliberately self-taught, acquiring his supreme knowledge of the art of command and of leading armies after he had passed the age of forty.

With the crushing defeat of the French in 1870 by the Prussian-trained German armies following so closely after the German victory over the Austrians four years before, it became evident that the high command of the German war machine was deserving of the closest study. As a matter of fact the expression "war machine" has passed into current speech as typifying an organization so skillfully built up and so efficiently administered as to take on the characteristics of a piece of well-designed machinery. It required only cursory investigation of German military writings to ascertain that their theories were derived from methods which had proved successful in past wars, irrespective of traditional military ideas or concepts. It is one of the odd failings of the human mind that it tends to be unreceptive to what may be called displacing concepts. The mind may be entirely open to ideas which are additional to the sum total of its knowledge, but it resists with a certain perverse stubbornness those ideas which, if accepted, displace or change the aspect of knowledge already motivating its actions. So it was that the French, who had every reason to analyze the methods which made Napoleon successful, who had the writings of the distinguished Jomini as a text, came to have

the bitter knowledge that the Great Emperor had taught his enemies, through the experience of their many defeats at his hands, the theory of his success, even as Hannibal had done for the Romans. It rested with the Prussian general staff to put these theories into practice, with what results we know. We know too that it rested with the American Admiral Mahan to indicate the underlying principle of the greatness of Nelson's career before the world at large grasped the true theory of naval leadership.

Now it was Marshal Foch, as head of the *École de Guerre*, who expressed the thought that practice flows from theory, and that theory gets her lessons from genius. For the theory then of exercising command of armies and fleets we should get our lessons from the most successful military and naval leaders. Unfortunately the command methods of the very greatest of these leaders are practically unknown, with the happy exception of those of Napoleon and Nelson. We know, however, that Alexander, Hannibal, Cæsar, Napoleon, Nelson—all had one quality in common—the ability to place themselves humanly in close contact with those whom they commanded, to identify themselves, in the fullest sense of the term, with their commands. They appear to have established this relation wholly without loss of dignity, with no suggestion, certainly, of ingratiating themselves, and without the slightest loss of control. This quality of being at once intimate and aloof, enshrined in the hearts of those who served them and yet never regarded with familiarity is essentially godlike. In other words, it is a transcendent quality that defies complete analysis and yet is known to be the common attribute of great leaders of men in every field—not alone in that of arms. There have been some successful military leaders who have lacked it or have possessed it in a minor degree. Wellington is a notable example. But it is a quality that stands out conspicuously among the attributes of practically all of the leaders who have attained any outstanding degree of success. It is so specific an attribute of greatness that there are numerous instances where the admirers of men of small attainments have deliberately set out to establish for their heroes a reputation for the possession of this latent quality.

Undoubtedly prestige enhances the power that some leaders exercise over their followers. A reputation for victorious achievement, even when undeserved, begets in the mind of subordinates an attitude of devotion which tends to set up what might be called an inertia of success, but prestige and reputation are far from fundamentals in the exercise of command, whereas ability to identify one's self in a greater or less degree with one's command is one of the basic elements in successful leadership. The greatest leaders have possessed it in the highest degree. Leaders of lesser magnitude have never been without it and remained successful. We all know the classic story of Alexander's rejection of the helmet full of water during his pursuit of Darius, basing his refusal to drink on the plea that his followers needed the water more than he. "Such things endear a leader to his men beyond the telling." Speaking of Hannibal's later campaigns in Italy when, against tremendous odds, he held his own for thirteen years against the best of Rome's generals, Colonel T. A. Dodge writes: "The Roman Army was superior to his own in all but one quality—the strange influence which a great man exercises over men."

This ability to impress one's self on one's command, so characteristic of the great military leaders generally, begets in the command the same will to endure, to fight, to win that animates the leader himself, and arouses to their fullest exercise in each individual all of those moral factors—the common possession of mankind, from the highest to the humblest—which contribute to a successful issue. The will to succeed, however, cannot alone make a successful leader. There must be ability and knowledge acquired by training and study. There is no escape from the hard work and painstaking effort of preparation, if one is to exercise command effectively. Nor can this period of drudgery be confined to a limited span in one's lifetime—to the years of youth when the expenditure of energy ordinarily requires the least effort. Effort must be continuous. Not that study of the art of command should be uninterrupted; not that training for exercise should be unchecked; but one's routine of living should be habitually shaped toward the acquisition of those attributes of mind and heart and those features of bearing and physique, and toward a grasp of those essential facts of human

knowledge that contribute, each and severally, to the attainment of successful leadership. Above all things must one dismiss the idea that none but innate geniuses have attained real success in the exercise of high command. Spartacus, the Thracian shepherd and slave to Rome, was not born a genius, but as a robber chief in his native Thrace he studied the art of war and was enabled of that knowledge to lead a temporarily successful revolt against the organized power of Rome. Toussaint l'Ouverture, a full-blooded negro, was no intuitive warrior, but a student of French methods and one who applied them in practice better than his opponents who had access to the same fields of knowledge. Alexander and Hannibal were thoroughly schooled by their respective fathers, both military leaders of note.

Thus does investigation reveal no open sesame to success in the art of high command. Thorough training, exacting study, keen observation, all of which mean hard work; that compound of kindliness, selflessness, and sympathetic understanding, which constitutes humanness and which, by effort, can be cultivated; good judgment and self-command or poise, with utter absence of pose; intelligence, not necessarily of that variety denominated high, but that which is characterized by the ability to grasp quickly—these, with executive ability and health and strength, are indicated as desiderata. To these essentials, which lie measurably within the capacity of attainment of every officer in the military or naval service, there must be added opportunity, as it were, a flux. Under the hammer of a dominating will, beating into cohesion the elements we have noted as emanating from self-cultivation, there emerges the leader—a man derived of study and meditation and self-denying toil; a principal under no mistaken conception that he has been born to command and, in consequence, free from what some one has called the "laziness of mind or the impudence of ambitious ignorance, which says to itself that after all it will find perhaps at the critical moment the so-called inspiration to direct with a sure hand the complicated movements of masses of a million men."

Theory demands that every unit, every element, of an army or fleet shall respond to the will of the commander as does he himself. We have seen that the greatest commanders have in the highest degree possessed what many writers have chosen to denominate a "latent quality" of impressing each his own personality upon his command, of animating his command with his own fighting spirit, his own will to win. The more thoroughly we study authentic records of these distinguished leaders, however, the more we are struck with the thought that this impressing of personality was accomplished in definite and understandable ways. In other words, we find that, from Alexander to Napoleon, on land and sea, the great leaders transmitted their ideas to their commands by the use of wholly practical methods of communication. Where commands were small, the leader addressed himself to his officers and men *en masse*. This method is tremendously effective, because it places the personality of the commander, as revealed in the spoken word, in direct contact with that of each individual of the command.

As forces grew and units multiplied, the commander was forced to resort to the transmission of his ideas to his command by conferring with the leading unit commanders. So did Nelson with his captains, and so did Napoleon, in his later campaigns, with his marshals. This method is less effective than the one of direct contact, but improves in effectiveness in the degree in which the commander is able to indoctrinate the subordinates with whom his contact is immediate. As commands continue to magnify, even a personal contact with the higher unit commanders becomes often a matter of difficulty, and the commander in chief is left with the necessity of so impressing himself on his staff that the administration of his command in all its minutest details shall reflect the spirit which animates the leader. It is often in the small, the tiny details of the exercise of command that a failure properly to respect the individual—his aspirations, his hopes, his vexations, his trials—begets a spirit of unrest, fosters a spirit of discontent and criticism and lukewarm loyalty. Alexander's rejection of water in the desert is known where the form of civil administration he set up in Babylon is forgotten. A faulty "by direction" imposition of some minor task out of one's turn or in conflict with one's approved program is remembered where a supremely ex-

cellent operation order for the carrying out of a fleet exercise passes promptly out of mind.

It becomes apparent that, in the practice of command and most especially of high command, and in the administration of armies and fleets, the ability to communicate becomes of the highest importance. The greater the inherent difficulty that exists in the ability to communicate, the simpler the methods of communication must be made. If persons of different tongues would converse, they must employ an interpreter, or one must learn the language of the other. If an untraveled American meets an untraveled Englishman, a free communion of ideas is difficult, until each has grasped the idiom of the other. Even in different sections of our own country, certain nuances of speech, certain modes of expression, must be made the subject of more or less reflection before intelligent communication is established. So it becomes of critical importance in the exercise of high command that the form of orders, the mode of their construction, the manner of their expression, and the choice of words employed in them shall be, in as many particulars as possible, standard, in order that communication may be swift, simple, and incapable of misinterpretation. Highly essential, then, in the courses of the various war colleges and schools of command is the training in "speaking the same language" and in formulating ideas be willing to follow the same thought processes, until such methods of thought become automatic.

Having established standard or accepted and well-understood methods of communication, it would appear that success in the practice of high command is governed largely by the power to communicate ideas. In the simpler manifestations of command, it is doubtless enough merely to issue the order or to state the plan. The reason for issue is obvious or is found in custom or doctrine or established routine. In the exercise of high command, however, the subordinate, in order to act intelligently and to use initiative, must not only be told the task he is to accomplish, but the reason why. As Marshal Foch puts it: "The power to command has never meant the power to remain mysterious, but rather to communicate, at least to those who immediately execute our orders, the idea which animates our plan."

In theory, the command of an army or a fleet is exercised by one man. In practice, the actual orders which issue to govern the administration of an army or fleet may frequently not emanate from the mind of the commander in chief at all, but may simply reflect his policies or evolve from instructions approved by him. It is therefore of basic importance that he look to his methods of indoctrination, his manner of communicating his ideas. Where, in the past, due somewhat to the size of armies or fleets, but largely to the external simplicity of life, there was very direct contact between commanders and their commands, now, with the increase in size of military and naval establishments and the highly complicated processes of modern life, the personality of the commander in chief tends to become more and more obscured. Imperfect indoctrination of his staff, of those who immediately surround his person and are presumed to reflect his will, may result in injustice being done or serious evils perpetrated in his name. His major policies may be carried out, but the personal touch may be utterly lacking. He may become a mystery through mere inadvertence, through a failure to realize that the collective attributes or qualities of his staff, his aids, the sum total of the characteristics peculiar to each, hover about him amorphously, as it were, until shot through with the directive force of his own personality, until transmuted into homogeneity of thinking and acting, until, in short, the medium through which the will of the leader projects itself to the farthest reaches of his command takes on a crystal transparency through which is manifest always the animating will of the commander in chief. Again this means work, effort, toil, for him who would succeed in command. "We must rid ourselves," says Professor Suzallo, "once and for all of that fallacy which insinuates that education is to be completed for any person within a given set of schools. . . . . We are made by the whole length and breadth of life."

The student of leadership, then, must, if he would learn how best to exercise command of armies and fleets, give close attention to the organization and functions of a staff.

A military or naval staff, in the present conceived meaning of the term, is a very modern product indeed. Generals and ad-

mirals have provided themselves with aides-de-camp and orderlies from time immemorial, but before the sixteenth or seventeenth century there was no suggestion of staff officers in the modern sense. The aides and orderlies were what their names imply—minor helpers, secretaries, messengers, who responded directly and without perceptible initiative to the spoken commands of their chief. In the latter half of the sixteenth century, however, it was found necessary from tactical considerations and the size and variety of army groups to designate an officer to set the army in battle array in accordance with the plan of the general in command, thus relieving the latter of that tactical detail and permitting him to devote his attention to the consummation of his plan and to such modifications of it as might be desirable in the course of the action. The officer so designated was a superior aide—one who at first had no direct authority in his own right,—who because he performed what had been one of the commanding general's or "captain-general's" most important duties had of necessity to be an officer with expert tactical knowledge. He was called the "sergeant-major-general," later "major general," and was in some cases given direct authority in his own person to command the foot soldiers. He was, of course, supreme over the aides and orderlies and was the first example of the modern chief of staff. In fact, the term "major general" in its original significance was applied to the chief of the French general staff as late as 1870. From this beginning of responsible assignments of duty to the general's aides, the staff idea slowly developed. Massenbach, who might be called the father of the modern staff idea, was unable to employ successfully in the art of command this instrument which he understood so well in theory. But Scharnhorst revamped the essentially sound ideas of Massenbach and, after fifty years of Prussian peace, the staff principle, with its fundamental tenets of "unity of command," "unity of doctrine," and "the initiative of subordinates," vindicated itself in the campaigns of 1866 and 1870.

Since that time, writer after writer has analyzed the general staff idea and nation after nation has applied general staff principles to the administration of its military establishments and especially to the conduct of its armies and fleets. Variations from the Prussian system are common and adaptations suitable to long established methods of administration have been essential. Everywhere, however, the underlying principles are similar, inasmuch as they are derived from a historical study of the art of command as exemplified by military and naval leaders who have been placed in positions where the exercise of high command involved the highest issues of state.

High Command Afloat

A staff organization afloat should aim at accommodating itself to our own existing departmental and shore station and fleet administrations, while preserving within itself the fundamental requirements of interpreting to his command the ideas, policies, and intentions of the commander it serves, of supplying him with the information essential to the discharge of his high functions, and of affording him the means by which he can impose his will promptly, understandingly, and unquestioningly on all of his subordinates.

It would be an error, under existing popular conditions in our country, to formulate an ideal organization for a supreme general staff, except as an academic diversion. Rather we must take what we have under the law and formulate the organization of our staffs afloat to conform to the restrictions so imposed.

The ultimate object of a military or naval commander is the defeat of an enemy in battle. To accomplish his object he must have a weapon, ability to use it, and a plan for its use. In naval warfare, his weapon is the fleet and the personnel who man it. His ability to use it depends not alone upon himself, but upon those who are to him as are the brain impulses motivating the individual warrior—the directive forces of the weapon under the controlling decisions of the mind—in other words, his staff. His plan for using his weapon, after assuring himself that it is a fit weapon, must be based on a knowledge of his opponent and a knowledge of conditions attendant upon the weapon's use. In high command, this assurance and this knowledge are beyond one man's capacity, and again the staff is indicated. The weapon must be a fit weapon. Therefore service functions having to do with upkeep, repair, replacement, and supply

of personnel, material, and funds must be represented on the staff. Knowledge of ourselves and of our possible enemies and knowledge of possible theaters of action are essential. Therefore the staff must have an information branch. With such knowledge, the commander is enabled to make detail plans, based on the basic war plans issued by the Office of Naval Operations. The weapon being fit and there being, based on due information, a plan for its employment, provision must be made to insure ability to use it—the fleet must be operated. The operations function of the staff is the culminating function, to which all other functions contribute. The exercise of this function is dependent upon the power to communicate. If the staff cannot communicate, it cannot function.

The staff of the naval commander—the brains of the fleet—if it is to accomplish the functions outlined above, must be so organized then as to provide in a broad way for maintenance, information, plans, and operations.

If the mind working through the brain finds the nervous system paralyzed, it cannot impose its will upon the body. The mind of the commander functioning through his staff—the brains of the fleet—imposes his will by means of: *Communications.* There must be for the commander and his staff—the mind—brain organization—a memory and recollection branch, where records are made and kept, where the results of past and current experience are set down for consultation and reference. In short, the staff must provide for: *Secretariat.* The human mind is prone to reason by analogy. This method of reasoning must be used guardedly, however, lest analogy run away with logic. The mind-brain-body allegory for picturing the relations between commander, staff, and fleet cannot be pursued too far, but it lends itself to clarity of thought in certain important particulars, and has been employed here, with a view to escaping from the diagrammatic, right-line method of picturing organization, which tends to implant the idea that the different divisions which may be depicted are coördinate and function with a certain measure of independence of one another, except as liaison is established by or through the chief of staff or his immediate assistant.

Every naval staff should provide for covering the following:

(1) *Maintenance.*—To include upkeep, supply, and inspection of material; provision of funds; supply of personnel; education; health, including medical inspection; welfare; morale.

(2) *Information.*—To include (a) intelligence in the ordinarily accepted meaning of the term, it being noted that this function would expand in time of war to comprise all possible information of enemy forces, plans, and dispositions; espionage and study of ciphers; censorship and press control. To include also a somewhat new function (b) information of our own force, as collected, sifted, and collated from general and special reports, reports of target practice, inspection of ships and special inspections, the specific object being to provide some means of following up, on the part of the high command, weaknesses or defects noted on inspections, and, under our present system, not again made a matter of information to the high command until the next inspection; of pointing out specific improvements that are necessary for increased military efficiency.

(3) *Plans.*—To include the preparation in peace time of schedules for operations, maneuvers, and exercises, with special reference to the basic war plans; tactical, strategic, and logistic problems; the preparation of detail war plans for the fleet, especially logistic plans, conforming to the Navy Department's basic war plans; in war time, the preparation of plans of campaign and plans of action; estimates of the situation.

(4) *Operations.*—To provide for converting the expressed will, intentions, or policies of the commander into orders and instructions, including necessary details; preparation of operation orders and tactical and logistical instructions; directing movements of ships; military inspections of ships and their personnel; keeping a record of own ships' positions and movements, and, in war time, those of the enemy so far as can be ascertained from "Information," and of own merchant ships; also, in war time, the handling of convoys and escorts and the safeguarding generally of marine mercantile traffic.

(5) *Communications.*—To provide for the receipt and transmission of orders, instructions, reports, and information generally throughout the fleet organization.

(6) *Secretariat.*—To provide for the preparation, reception, and distribution of

correspondence, including the circulating of papers within the staff; filing or the preservation of correspondence and the records of correspondence.

It is believed that every feature of fleet activity, both in peace and war, coming within the purview of the commander is covered by an organization of his staff which provides for the six functions just mentioned. These functions are in no sense coördinate. They are very definitely correlative, but the relations between them are not identical. The relation existing between the first four is a culminating relation. The fleet must be *maintained* in a fit condition; it must be *informed* of the conditions under which it may be called upon to act; it must have a *plan* of action; finally it must be used as an instrument of force, it must act, it must *operate*. The fifth function is a pervasive function, an animating function, the enlivening principle of staff activity. In other words, *communications* conveys to the command the results of staff work and informs the staff of the fleet's reaction to the will of the commander. The sixth function is introversive. The *secretariat*, by providing for the preparation, reception, and ultimately for the custody of correspondence, affords a mirror, as it were, in which the work of the staff and of the fleet is seen reflected in such a manner as to afford a check on the past, an immediate image of the present, and a guide for the future.

In the actual organization of a staff, the tendency to set up these functions as coordinate functions of staff activity must be rigidly guarded against, nor must one function be subordinated to another. Irrespective of the rank of the officers who may carry on the six essential functions and irrespective of the extent of the personnel engaged in the performance of work in the various spheres of activity, the functions themselves have no rank. They have an intimate interrelation which no right-line diagram can depict to the eye and any attempt to convey such interrelation graphically may readily lead to decided confusion of thought. The brain of the fleet is no more to be considered as a rigidly coördinated assemblage of independently functioning divisions or sections presided over by the chief of staff than is the human brain to be regarded in the discredited phrenological sense as an assemblage of special organs or loci through which the individual faculties of the mind are manifested under the predominant control of the human will.

There must be a clean-cut differentiation of the duties to be performed in each of the six spheres, along with intensive inculcation of the thought that the liaison between the spheres must be as complete and unequivocal as human nature can compass. The grave defect in our fleet staff organizations today appears to be the adjusting of the organization to give vent to the peculiar and special talents of the individuals with whom the unit commanders surround themselves. It is as if our unit commanders, having in mind the generally accepted staff titles, sought out the best available engineer, gunnery man, radio expert, paper-work specialist, War College graduate, and so on; and with this assemblage of really talented and efficient officers set about the forming of his staff, the functioning of which becomes immediately dependent upon the characteristics of strong-minded and able men, rather than upon correct basic conceptions of what a staff is intended to accomplish. Such a staff is a personal rather than a functional organization.

As a point of departure for what the writer refers to as a functional organization of a fleet staff, let us take what we actually find in certain fleet publications to which we have present access and fit the titles and duties there set forth as nearly as practicable to the functional organization suggested in this paper.

We have these actual titles:

Chief of staff	Aviation officer
Assistant chief of staff	Surgeon
Flag secretary	Paymaster
Flag lieutenant	Constructor
Tactical officer	Athletic officer
Gunnery officer	Personnel officer
Engineer officer	Marine officer
Radio officer	Chaplain

We have set forth for us these divisions, the word being employed to connote groupings of duties and not sub-organizations of the staff organization:

Operations	Inspections
Training	Morale, athletics, and discipline
Personnel	Intelligence
Material	Staff administration
Finance and supplies	Communications

We strongly question the propriety of designating "staff administration" as a major division of staff activity, but we include it, because it is so set down. We add, however, because its omission is clearly indicated as involuntary, inasmuch as it is covered in the detailing of duties, the division of "planning." In segregating the above titles and divisions or work groups under the functional organization proposed, we are governed by the detail assignment of duties set forth in the "Staff Instructions," of two of our major fleet organizations. It will be noted at once that there are numerous repetitions of titles, because our present staffs tend habitually to combine in the person of one officer maintenance and operation duties, plans and administration, and so forth. These repetitions may serve to point the way to future changes. They at least suggest that our present staff organization is not altogether sound. We have then as a basis for a functional organization the following grouping, which, of course, does not look encouraging and is not to be commended, but which does give us a practical starting point, inasmuch as a staff having the titles and work groups here set forth did actually administer one of our largest forces afloat:

Maintenance.—Engineer officer, gunnery officer, radio officer, aviation officer, surgeon, paymaster, constructor, athletic officer, personnel officer, marine officer, and chaplain, who handle personnel (including education or individual training), material, finance and supplies, inspections (of material), and morale, athletics, and discipline.

Information.—Marine officer (or other designated) who handles intelligence, and all staff officers who handle inspections.

Plans.—Chief of staff, tactical officer, engineer officer, gunnery officer, aviation officer, constructor, marine officer, who handle planning.

Operations.—Assistant chief of staff, tactical officer, engineer officer, gunnery officer, aviation officer, flag lieutenant, who handle operations (in the restricted sense of the circulars consulted), training (of the fleet), inspections (military), staff administration.

Communications.—Flag secretary, flag lieutenant, radio officer, who handle communications.

Secretariat.—Flag secretary who supervises what is not specifically denominated a secretariat in the circulars consulted, but which is essentially such from the nature of the duties attaching thereto.

It is believed that the mere perusal of this list of titles and these divisions or groupings of duties now obtaining will indicate a need of considerable readjustment before we can hope to arrive at a well-balanced functional organization. Our own *Navy Regulations* are particularly vague on the subject of staff organization. They insist on an operations division in staff organization, of which an assistant chief of staff shall be the head. They imply that a flag secretary and flag lieutenant are presumed to be on every staff. Beyond these features of organization, expressed or implied, they are hardly specific. They do intimate that the Navy Department may prescribe divisions other than the operations division "for the proper administration and operation of the fleet during peace and war," but so far no additional divisions have been prescribed. It is noted that our Army differentiates sharply between the planning and operating functions on the one hand and the technical and administrative functions on the other. Operations and administration, however, are too closely allied in naval work afloat ever to lend themselves to a differentiation which would facilitate rapid and effective staff work. It must be borne in mind constantly that the purpose of the staff is to provide an efficient means for the commander to impress his will upon the fleet. It must function rapidly and to the point. The chief of staff, who is the immediate adviser of the commander, the officer with whom the commander habitually consults, the one to whom he looks directly as his executive for the carrying out of the policies of the high command, must himself be freed from the necessity of consulting too many officers. To be sure, the chief of staff's touch with staff work must be intimate and all-pervasive; he must insure that the plans of the high command are harmoniously executed; he must supervise and coordinate the work of the staff as a whole. But he can more speedily and thoroughly do these things, if the enormous and increasing range of staff activities are grouped under a minimum of divisions, each presided over by a competent and specially trained officer who himself is thoroughly cognizant

of the basic functions of staff work and fully indoctrinated in the principles of command.

Let us see what can be done along functional lines without changing the total number of officers so far considered, viz., sixteen. Primarily, we shall consider that the chief of staff, in acting as the executive in carrying out the policies of the commander and in supervising the work of subordinate staff officers, besides performing certain personal duties which have mainly to do with relieving the commander of details with which otherwise he personally would have to charge himself, such as supervising the navigation of the fleet or such portion of it as may be in company, providing for an appropriate adjustment of the administration of the fleet flagship to the presence of the staff on board, setting uniform, making certain calls, and so forth—we shall consider, we say, that he is best freed from immediate direction of any one particular function of the six functions of staff activity we have previously listed, in order that he may more fully labor for that degree of harmony and liaison in the staff which shall cause it to exercise its functions as a perfectly coördinated whole.

In proceeding to the first functional division, that of *maintenance,* which, in our conception, has to do with rendering the fleet, in a broad physical sense, fit for fighting as distinguished from fit to fight, which latter phrase connotes training and skill, in addition to physical readiness, we at once find it desirable to break away from some of our familiar staff-officer titles and consider a sub-organization of the staff which shall be charged with the supply and upkeep of personnel and material. Considering the fifteen officers whom we now have available, since the chief of staff is duly assigned, let us choose, without regard for his present title, the engineer officer. Let us assign him the highly important task of looking out for the physical maintenance of the fleet, being particular that both his ability and his rank are commensurate with the major task imposed. His assistants are, on the personnel side, the officers now assigned the titles of personnel officer, surgeon, marine officer, and either the athletic officer or chaplain (one, not both; because we have other employment for the additional officer). On the material side, he may be served by the officers now assigned the titles of radio officer (who may be assigned certain personnel duties), constructor, paymaster.

For *information,* we use the extra officer we have obtained by combining athletic, welfare, and other associated or related duties under one officer under maintenance. One officer may possibly be sufficient in peace time, provided he has proper clerical assistance. He handles and collates intelligence data and the information of our own forces furnished in inspection and other pertinent reports. He must work in intimate liaison with plans.

For *plans,* we use the tactical officer whose duties would be much more extensive than at present and would be largely unrelated to the duties assigned to the present officer of that title. He should properly be an officer of wide experience, thoroughly cognizant of the physical condition of the fleet —its fitness for operating, and of national and international conditions, as well as conditions in general in the naval service. His duties comprise not only the fleet's development of the basic war plans, but the preparation of programs of employment, including overhaul and docking, and plans for fleet maneuvers and exercises. This division of staff activities would be considerably expanded in time of war.

To *operations,* supervised by the assistant chief of staff, would be assigned the gunnery officer and the aviation officer, but not necessarily with these titles. The assistant chief of staff, whether or not he retained that particular title, would be called upon to have the same general attributes as at present. The gunnery officer, however, whatever his knowledge of gunnery, would be called upon to have somewhat the point of view of the leading officers in the Division of Fleet Training of the Office of Naval Operations. He would be concerned with engineering competitions as well as gunnery competitions. He would have no immediate duties regarding the armament condition of the fleet, in the material sense, that being a function of *maintenance.* The aviation officer would not necessarily, in his capacity as an assistant in operations, be so entitled. It would appear well in the present state of aviation development to have an aviator on the staff, but his duties need not be narrowed down solely to aviation. He should be a real assistant to operations in general,

with his consultative knowledge of aviation always available.

Communications would preëmpt the services of the flag secretary and the flag lieutenant. The personal aid features of the latter's duty are, of course, extraneous to communications, but are essential and can be performed without reference to the functional organization herein outlined.

The *secretariat* function, although distinct from that of *communications,* is allied to it objectively in obvious ways, and can readily be supervised in peace time by the flag secretary.

It is apparent, in using our sixteen officers as above outlined, we have been influenced by staff corps considerations in assigning a preponderance of officers to maintenance. This phase of staff organization is a difficult one. The Army makes a distinction between the general staff of a command and the technical and administrative staff. This distinction does not reduce the total number of officers assigned to staff duty, which is the great desideratum in any staff organization suitable to the restricted physical limits of a vessel afloat. It is conceivable that, if squadron staffs were provided with surgeons and paymasters, no surgeon or paymaster would be essential on the staffs of higher organizations of the fleet. Thus the poorly officered information and plans divisions might each be afforded another officer at the expense of maintenance. There appears to be a real place for the fleet marine officer, so long as marines are carried afloat and marine landing forces of considerable proportions are a possibility. The need of force or squadron marine officers is not so great. It is, of course, not essential that the legal duties of the staff be performed by a marine officer. On account of the small size of the Construction Corps and the desirability of having some constructors always at sea, there appears to be reason for having a constructor in such forces as habitually operate separately and unite only infrequently for maneuvers or the like. A fleet chaplain, as such, has no place. The title smacks of church hierarchy and has no legitimate reason for being included in a naval staff organization. If a member of the Chaplain Corps is particularly fitted to supervise welfare, athletic, and associated activities, as they have place in the functioning of a staff there would appear to be no objection to his assignment to such duty. The same considerations might apply to a medical or supply officer, but the duty would be assigned such an officer independent of staff-corps consideration. This assignment to staff-corps officers doing duty on a naval staff afloat of duties independent of or in addition to staff-corps functions appears justified by the success which marks the work of staff-corps officers at the Naval War College, where their specialties are not given particular consideration. The tendency of a staff organization which stresses too much staff titles and cannot become accommodated to giving any but medical duties to an officer of the Medical Corps or any except supply or disbursing duties to an officer of the Supply Corps is especially unfortunate.

If, instead of permitting any staff-corps considerations to affect other than mediately the duties to be assigned to members of a naval staff organization afloat, we take a number of officers not exceeding the total number assigned to, say, the Battle Fleet, where we find twenty-two officers all told performing staff duty, and, with this number, we organize on the basis of our six functions, we could arrive at an organization similar to the following:

Chief of staff—Line officer of command or flag rank.

Maintenance—Six officers, at least three to be line officers.

Information—Two officers, at least one to be a line officer.

Plans—Two officers of the line.

Operations—Five officers of the line, including one aviator.

Communications—Five officers of the line, including the flag secretary and the flag lieutenant.

Secretariat—One officer.

The staff organization above outlined covers functionally, in a balanced manner, all possible duties that a naval staff may be called upon to perform. The number of personnel may be increased or decreased at will according to the burden of work or the size of the naval force under the commander concerned, without the arbitrary readjustments of duties not uncommon in existing staff organizations, when personnel is changed. The secretariat function, when personnel considerations demand it, can be

combined with communications. Likewise information and plans can be combined. Still further combination might warrant the linking together of information, plans, and operations, in which case we might expect the chief of staff to perform the normal duties of the assistant chief of staff, in addition to his own, the latter title not appearing on our staff roster. It is in the small staffs especially that staff-corps officers would most advisedly be assigned duties outside of and in addition to their particular specialties. If the practice of assigning such additional duties should become commonplace, there would be no more criticism of it than we now accord the practice of burdening the average line officer in a small staff with all manner of multifarious duties. Such a practice would enable our necessarily small destroyer squadron staffs or light cruiser division staffs to function with greater efficiency.

It is believed that the faultiness of our present staff organizations afloat lies largely in a failure to visualize the basic mission of a naval staff. Evolving as they did from the original flag lieutenant and flag secretary of a small force, in which the flag officer himself was able to and did perform personally all of the important functions of command, they have grown gradually to such proportions as to warrant thorough examination and analysis, lest they take on the aspect of a bridge so weighted with the means of transportation as to impede the progress of those for whose use it is designed. This exhaustive examination and analysis have not been made. There has been at times a tendency to attempt the application of Army staff organization to naval staffs. Such an attempt is doomed to failure as long as the Navy is without a supreme general staff, nor is it probable that, even with such a supreme staff, the organization of naval staffs afloat would follow Army lines. In land warfare, in its purely objective and material aspect, there is no real counterpart to the fleet. Consequently what we have denominated maintenance in our discussion of naval staff functions will always demand a conspicuous place in the exercise of high command afloat. The sharp differentiation made in the Army between war staff duties and what are classed as technical and administrative staff duties is not at all in harmony with present naval organization nor with commonly accepted naval concepts of organization. Insofar as possible the fleet must be fit for fighting at all times. The commander therefore must have at hand the agency for keeping him in intimate touch with this phase of his exercise of command. In other words, *maintenance* in any conception of naval staff organization is primary and elemental. As expressed before, it is the function of making and keeping the weapon ready for use. It is therefore the foundation function. With the essential aid of *information,* we are enabled to draw up appropriate *plans* to conduct our *operations,* which, through *communications,* culminate in action, the reaction of which is reflected in our *secretariat.*

Whether or not the basic functions of a naval staff have been correctly deduced in this paper, it is at least apparent that our present naval staffs, efficient as they may be in their activities, are heterogeneous in composition and possess generally only such organization as the particular personal talents and characteristics of their members dictate, which organization is not standardized and is primarily non-functional. The remedy for this condition lies within the power of the Navy itself to prescribe and administer. The results to be obtained in increased fleet efficiency by the administration of the proper remedy are incalculable.

The New Competition

By LIEUTENANT (J. G.) THOMAS J. CASEY, *U. S. Navy*

CONFERENCES may dictate policies and may clear the air of international doubt and suspicions, but they can never change human nature to such an extent that there will be no more naval competition. If an agreement is reached such that the sizes and numbers of ships that the different powers may have are restricted, competition to build the best ship within the limitations will still go on. If naval armaments were restricted to rowboats, human nature would compel each government to try to build the best rowboat.

None of this is intended to belittle the results that peace conferences have attained or may attain. There is no doubt that a restriction in the size and numbers of warships might mean the lifting of a huge burden from the backs of taxpayers, but competition would not be eliminated. Defense and security would be obtained at a cheaper rate, which would be highly desirable, but naval architects, engineers, and ordnance experts would vie with one another to pack the biggest punch in a given tonnage. In other words naval competition will become a question of developing the *best* ship instead of the largest ship.

As naval officers, paid by the people of the country to afford them protection and security while they proceed about their business, it is our duty to give some thought to this form of competition. What can we do about it?

It may be interesting and instructive to turn to Germany's answer to this question. In the Treaty of Versailles, Germany's Navy was so limited that it could never again become a factor in control of the sea. So the statesmen at Versailles thought a few years ago, when the largest displacement allowed Germany was 10,000 tons. With characteristic resourcefulness, the Germans went to work to overcome this handicap, and about a year ago developed the *Ersatz Preussen* which astounded the world. Her characteristics are well known and perhaps too highly rated, but she is an excellent example of the type of competition which will take the place of the present variety, if a limitation conference succeeds.

In the case of the *Ersatz Preussen*, radical economies in weight were effected by the architects and a very efficient gun battery designed by the ordnance experts, but perhaps the most radical steps were taken in the engineering department. She is powered with Diesel engines, which in themselves are a radical departure from conventional warship design. The astounding feature is that these engines are rated at seventeen pounds to the horsepower by the Germans. This, too, may be an exaggeration since analyses of her displacement based on the usual percentage of tonnage distribution would show her engine weight per horsepower to be considerably higher, but still well within previous best results for such a large engine of about sixty pounds per horsepower.

Here is considerable food for thought. In the first place, assuming that an arms limitation conference can emulate the good example of Premier MacDonald and President Hoover and meet on such a basis of good will that real results can be obtained, how far in its slashing policy should such a conference go? There has been talk of doing away with the capital ship, but can this country or any other country afford to dispense with capital ships when Germany possesses such a powerful weapon as the *Ersatz Preussen?* If so, radical changes in design must be undertaken by other countries to follow the lead set by Germany.

If this form of competition becomes a fact, as it seems to have every chance of being, we must be prepared for it. Our naval architects can probably accomplish as great savings in weight of hull structure as the Germans did—in the case of the *Ersatz Preussen* roughly 5 per cent. Our ordnance

experts can, no doubt, produce equally efficient armament. But what is the answer to the engineering problem?

The Germans answered it with the Diesel engine, but this solution is not favorably regarded in our Navy. There is much to be said on both sides of the question of Diesel engine versus steam engine and only the most thorough expert may render an authentic decision based on facts. One fact, however, is readily apparent, and that is that the United States Navy is not yet ready to accept the Diesel engine as the main source of power for large surface ships. We must, therefore, confine our attention to steam.

One acceptable solution is to follow the lead of shore practice and use high-pressure steam. To present some conception of how the use of high pressures has increased, in 1876 at a convention of mechanical engineers a need for a standard steam pressure became apparent, and the standard was set at seventy pounds per square inch. Today, in the Navy, we are accustomed to 250 pounds per square inch, and in some installations we have 300 pounds per square inch—quite a jump from the days of 1876.

It is interesting to consider what has prompted this advance in pressures and why we have not advanced further. The answer to the first consideration is simple. With high pressures greater horsepower can be obtained per pound of machinery and per cubic inch of volume occupied. These two factors coupled with efficiency are the bases of all calculations in naval designs, because weight and volume displacement must be cut down to a minimum. A cubic foot saving of machinery space means an additional cubic foot of magazine volume. A pound saving in machinery weight means a pound increase for gun weight. High pressures become a necessity.

But why have we stopped? Why have we not used 3,000 pounds per square inch instead of 300? The metallurgist knows the answer to that, for we are limited by the fact that carbon steel can be used safely up to a temperature of only 750 degrees Fahrenheit. Above that point the internal structure of the steel so changes that it is unsafe to subject it to pressure. This assumes that superheating will be used.

We are, therefore, limited by the temperature which the metal of the tubes can stand and we must look to the metallurgist for the solution of this problem. Some success has been attained along this line and metals are available—at a price—which will stand 1,100 degrees Fahrenheit. The price is prohibitive for general use, but there can be no doubt that the metallurgists will produce the necessary material eventually at a commercially practical price.

At present, in shore practice, there are two ranges of pressure widely used. These are the 600-pound range and the 1,200-pound range. Stations are operating successfully at both these pressures—there is no reason why the Navy cannot follow suit.

Some search has also been made for more desirable fluids but as yet no attempt has been made to supplant water commercially. One such fluid is a mixture of diphenylamine oxide which is recommended because of its peculiar entropy characteristic. The vapor from this liquid, when expanding, actually has a decreasing entropy characteristic instead of an increasing one like water. At Hartford, Connecticut, there is a plant which operates on mercury vapor. Mercury is used because of its low saturation pressure at relatively high temperature. This may seem rather paradoxical since it has already been stated that temperature was the troublesome factor in the use of water, but it must be kept in mind that heat does the work and not pressure. The advantage that mercury has over water is that the former will take up a greater amount of heat at a lower pressure than water will. In order to get water to take up a certain amount of heat it must be allowed to develop a certain definite corresponding pressure, which in the case of water is much higher than in the case of mercury. In the plant mentioned at Hartford, Connecticut, the mercury is vaporized in a specially constructed boiler at a pressure of only 85 pounds absolute but 884 degrees Fahrenheit. It then expands through a mercury turbine to a pressure of 0.75 pounds absolute whence it goes to a condenser, where it is condensed to liquid mercury, but in giving up its heat to the cooling water vaporizes the latter, forming steam at 300 pounds absolute and 417 degrees Fahrenheit.[1] This steam is further superheated by the stack gases, expanded through a turbine, condensed in the usual

[1] Data from *The Principles of Engineering Thermodynamics* by P. S. Kieffer and M. E. Stuart

manner, and returned to the combination condenser-boiler. The specific heat of mercury is such that the heat to be taken away from one pound of mercury vapor to condense it will vaporize about nine pounds of water at the pressures in use. This plant gives excellent efficiency, but the use of mercury has several objectionable features, chief of which is the poisonous nature of the mercury vapor, which would render it unsuitable for use on a naval vessel. It is mentioned here merely to show the ramifications of engineering investigation, and what we may expect in the way of originality in the new type of competition.

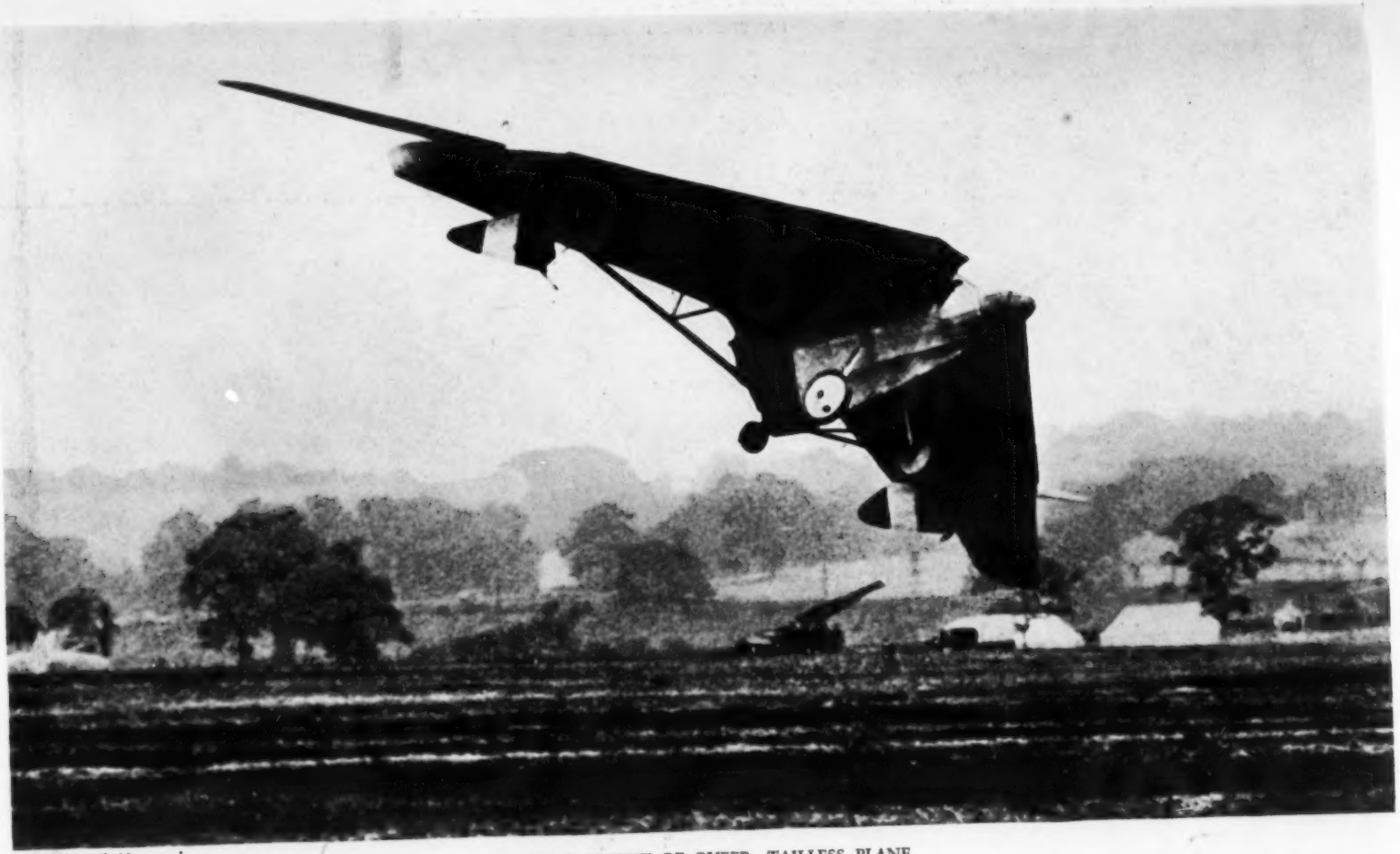
A consideration of the modern methods to attain best efficiency will be worth while. Not all phases of investigation can be considered in a paper of this length, but the question of the degree of wetness of the steam itself will be interesting. Wetness of steam causes erosion of the turbine blades with consequent reduction in efficiency as the shape of these blades is altered from their designed shape. In addition the steam carrying the water film incident to wetness is retarded by this film as it passes through the blades and nozzles, and a considerable portion of its velocity is lost. However, the steam cannot be held in a superheated condition throughout the expansion, so some degree of wetness had to be chosen as the limit. By experiment this degree of wetness was found to be 10 per cent to 12 per cent[2] at the exit from the last blade; consequently, best practice is to raise the steam to the desired pressure and degree of superheat in the boiler and expand it through the turbine until its quality is between 86 per cent and 88 per cent. Then it is sent back to a reheater where it is heated to such a degree that when it comes out of the last stage of the L.P. turbine it will again have a quality of roughly 87 per cent. This is called the reheat cycle, and the limiting degree of wetness determined upon is a result of a compromise between erosion and velocity loss due to wetness on one side and condenser size and weight on the other.

Pressure will be the key to future developments in steam plants, and in order to get the best results from the new order of things the entire plant will have to be designed with an eye to best results with the higher pressures. On the strength of no less an authority than Dr. C. E. Lucke, the efficiency of naval steam plants can be almost tripled by the use of about 2,500 pounds per square inch and superheat. This increase in efficiency would mean not only an increase in steaming radius for the same fuel capacity, but a corresponding decrease in water rate, followed by a like decrease in size and weight of condensers and pumps attached thereto. This saving in weight and space would be tremendous.

Structural or tube safety is the big factor on which high pressure and high superheat depend. As long as a tube is wet it is safe, but superheater tubes are never wet. However, the temperature of these tubes may be controlled by the mass flow of steam through the superheater. The temperature of the superheater tubes will not be the same as the temperature of the steam, but the tube temperature will "follow" the steam temperature. In the water sides of the boiler, however, safety is dependent on the circulation of the water, and the circulation of the water depends on the height of the water column and the difference in density of the steam and water at the boiler pressure. The higher the steam pressure, the closer the density of the steam approaches that of the water, and, consequently, the more the vigor of natural circulation is impaired. At 3,200 pounds pressure per square inch the saturation and liquid lines cross, and at this point the densities of steam and water are the same. This means that there will be no natural circulation, and that artificial circulation must be resorted to before this point is reached. Somewhere between 1,400 and 3,200 pounds per square inch a pump must be installed to insure circulation in the boiler. This precludes the use of drums, as the pump could not insure circulation in a boiler fitted with drums which would counteract the work of the circulating pump. So perhaps the day is not too far distant when we shall have drumless boilers, with a consequent saving in weight and space.

The considerations mentioned here are only suggestions of what may be expected in the field of design, and they are by no means the only paths open to us for improvement. Naval engineers will have to keep abreast of the times to insure that the United States Navy shall not be outclassed in this new form of competition.

[2] From a lecture by Dr. C. E. Lucke.



International Newsreel

BAT-LIKE FLIGHT OF QUEER, TAILLESS PLANE

This flying machine took part in the aërial pageant of the British Air Force, at the Herndon Aërodrome recently. It is the nearest approach to the flight of a bird yet invented. The motive power comes from behind, tending to push instead of pull.

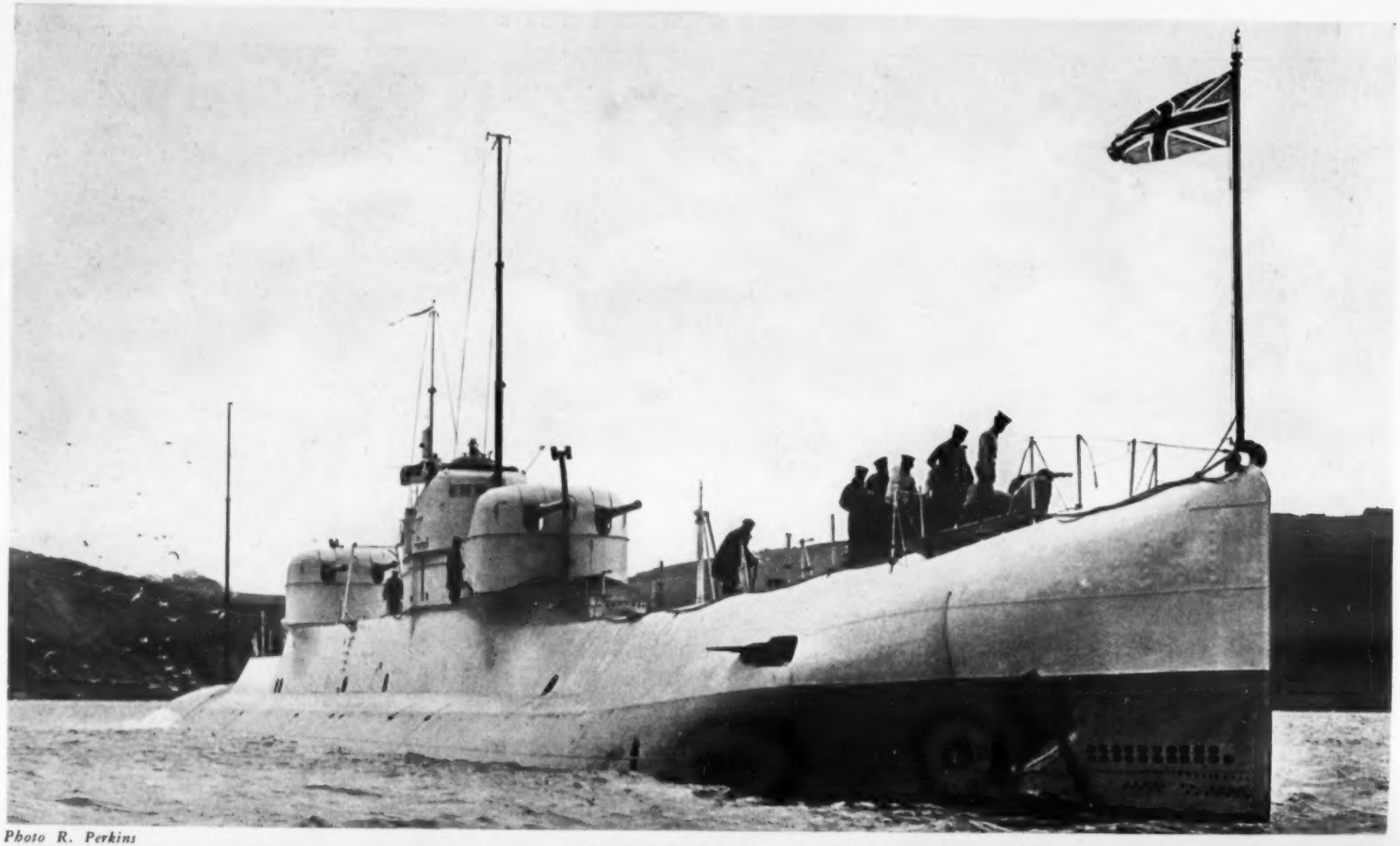


Photo R. Perkins

BRITISH SUBMARINE *X-1*

The four 5.2-inch guns are clearly shown in this photograph. One English paper recently referred to her as "a bit of a white elephant," and stated that she was to be placed in reserve.

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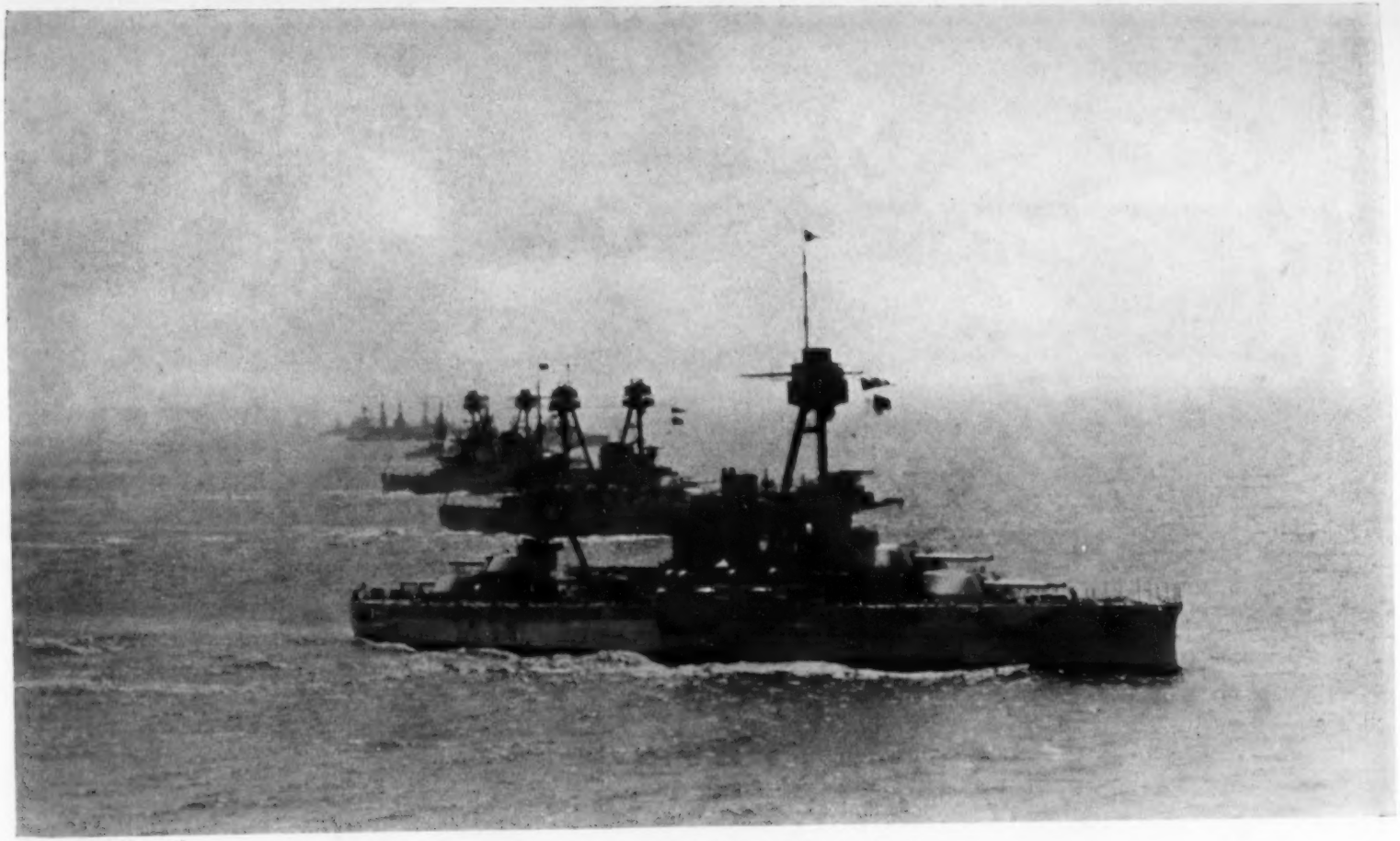

International Newsreel

REPULSING A "THEORETICAL NAVAL ATTACK"

Eight of the Navy's most formidable sea fighters lined up ready to repulse an enemy attack in maneuvers off the coast of Cuba.

UNIV. OF MICH.

Courtesy Rear Admiral G. W. Laws, U. S. Navy

U.S.S. *CHICAGO* LAUNCHED AT MARE ISLAND NAVY YARD ON APRIL 10, 1930

She is the sixth of eight 8-inch gun cruisers allowed the United States by the Washington conference of 1922 to take the water. *It is understood that this is the first time within recent years that two naval vessels have been launched within a month in any United States navy yard.* *(See opposite page.)*

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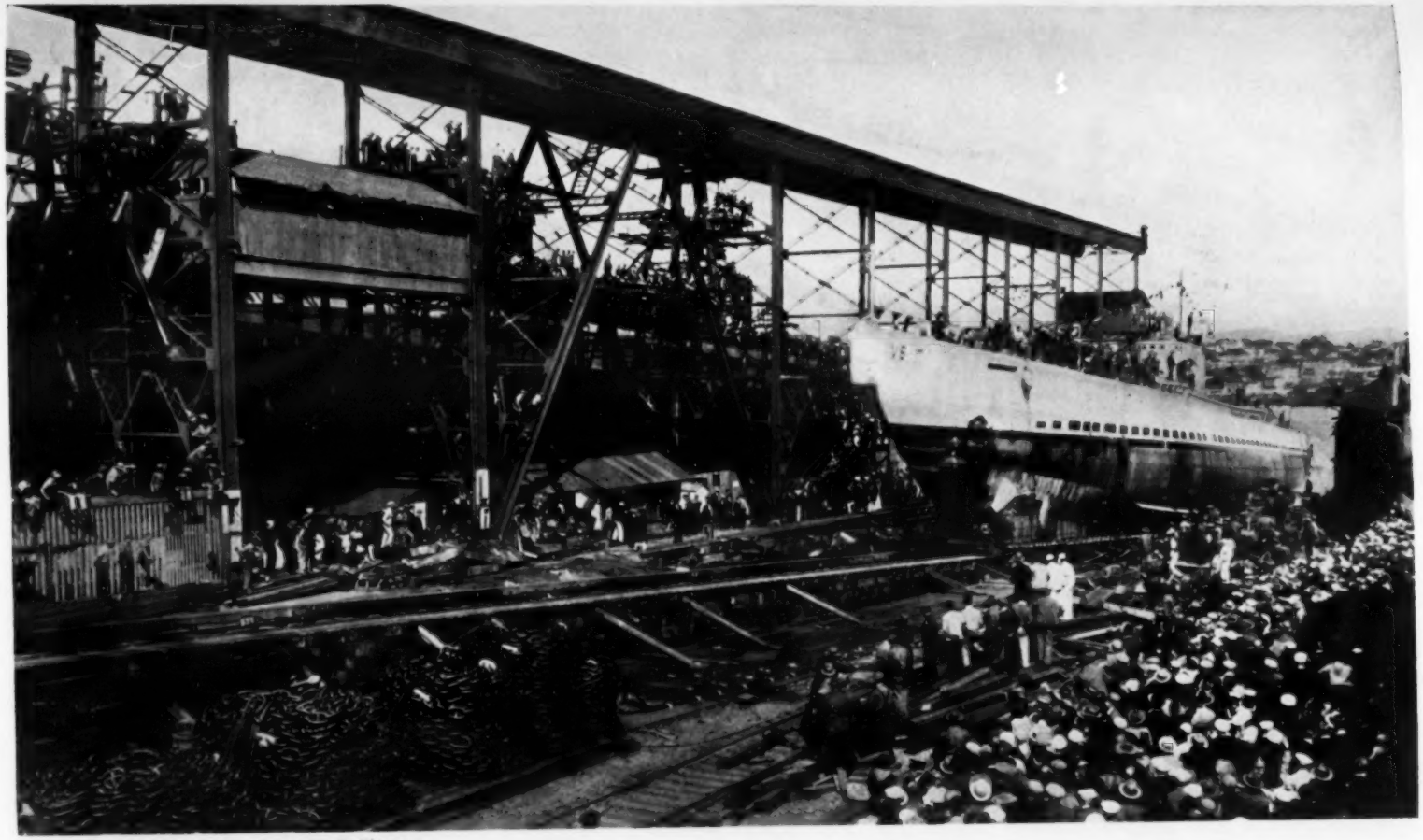


Courtesy Rear Admiral G. W. Laws, U. S. Navy

U.S.S. *V-6* LAUNCHED AT MARE ISLAND NAVY YARD ON MARCH 15, 1930

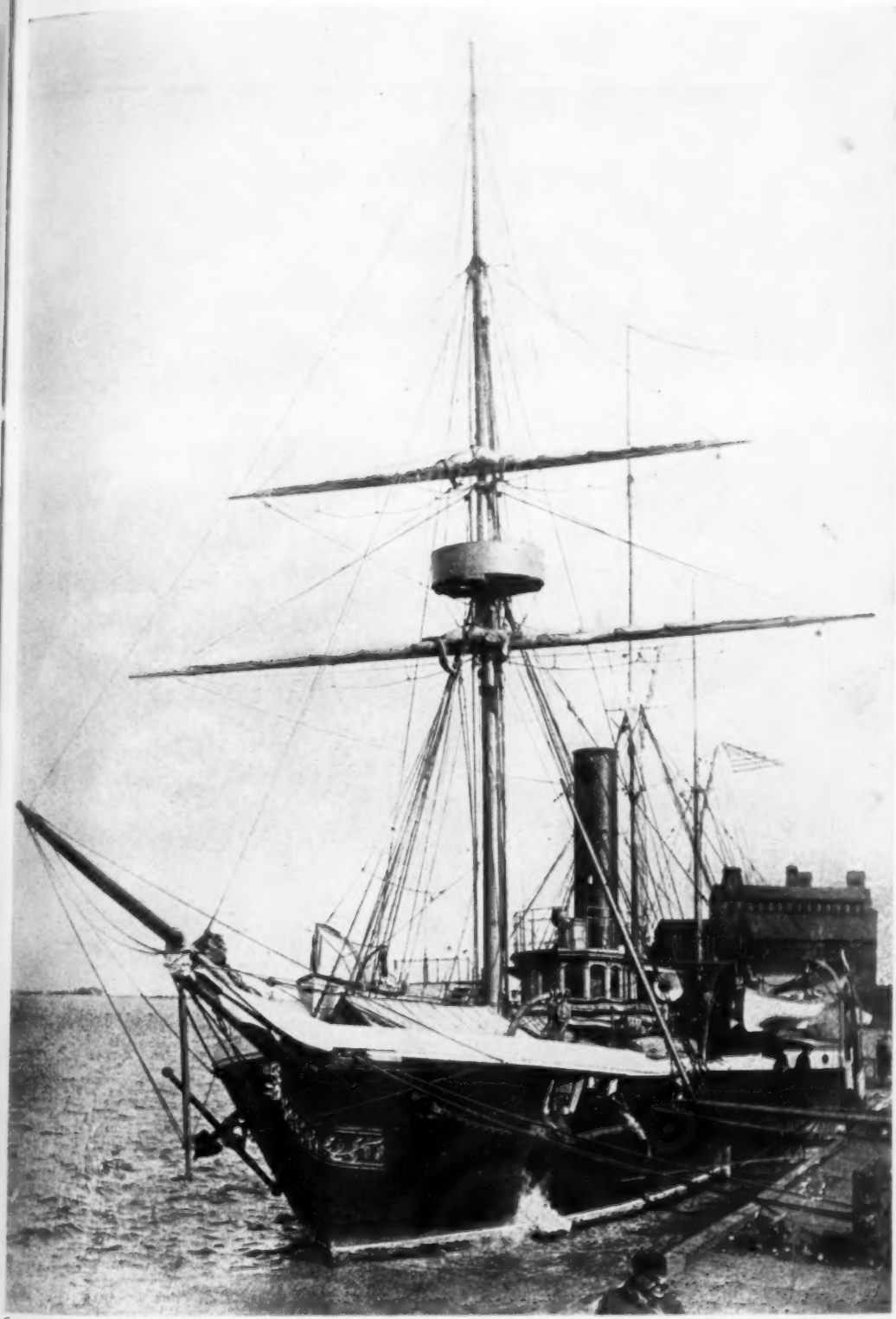
This submarine and her sister-ship, the *V-5*, have a cruising radius of approximately 20,000 miles. The *V-6* is 370 feet long and has a displacement of 2,760 tons, exclusive of fuel oil and two deck guns.

UNIV. OF MICH.

Courtesy Mr. Richard P. Joy *From a painting by Frank Vining Smith*

U.S.S. *MICHIGAN*, THE FIRST IRON SHIP OF THE UNITED STATES NAVY

In an article in the October, 1924, issue of the PROCEEDINGS, she was called "The Daddy of 'Em All" because she was not only the first iron ship of the Navy but also of any kind on the Great Lakes.



Courtesy Commander Walter E. Brown, U. S. Navy

THE U.S.S. *MICHIGAN* IN 1884

In 1905, after cruising "unsalted seas" for more than sixty years, the Navy Department renamed her *Wolverine*, so that her name might be given to a battleship.

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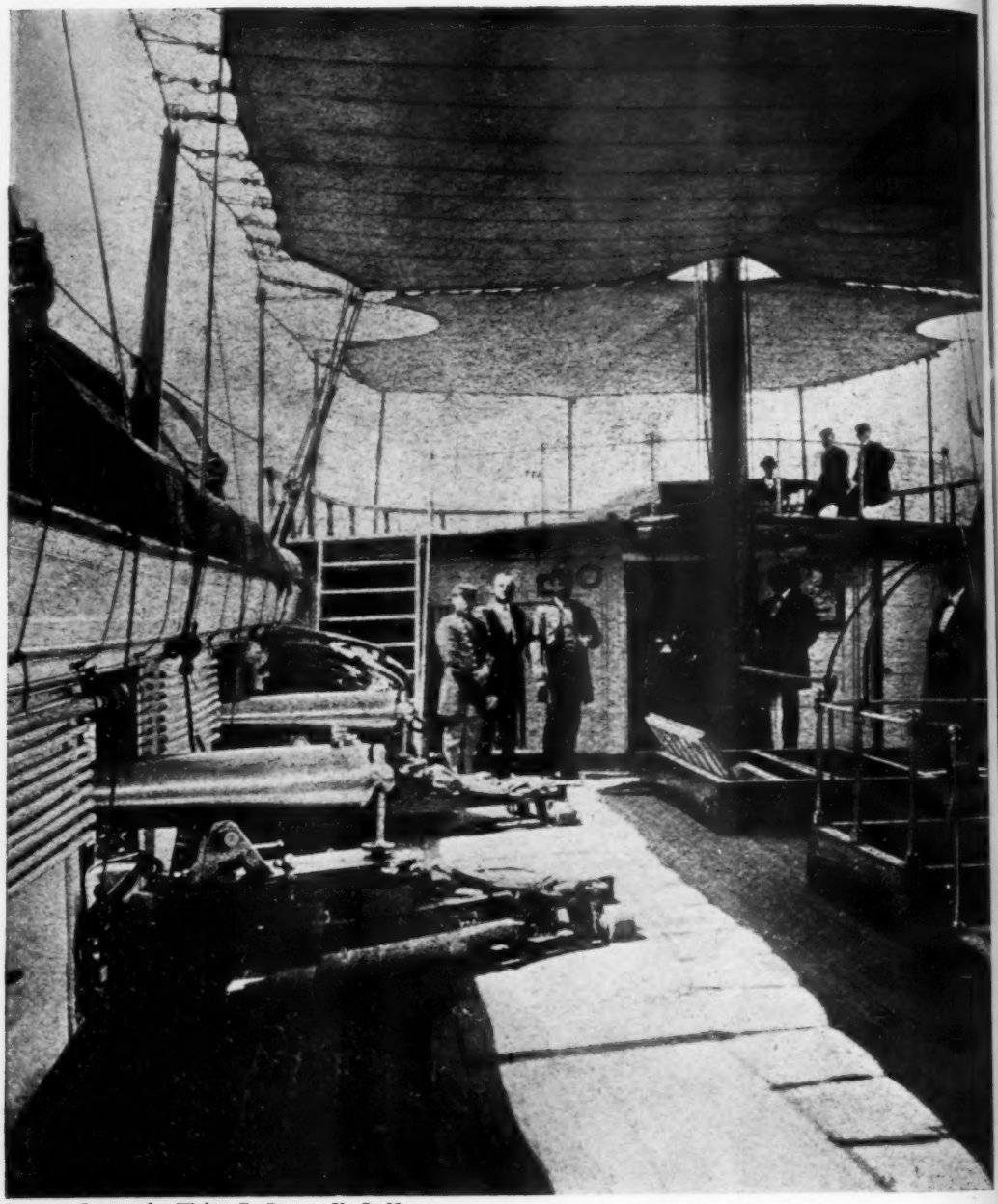


Courtesy Commander Walter E. Brown, U. S. Navy

THE SPAR DECK OF THE U.S.S. *MICHIGAN* AS IT WAS IN 1870

The parts of her hull were fabricated and fitted at Pittsburgh and then transported overland by oxcarts to Erie for erection. According to tradition, many of those present at her launching would not believe that an iron ship could float. The officer to the right of the hatch is Ensign Gridley, later captain of the *Olympia* at the Battle of Manila Bay, to whom Dewey said "You may fire when you are ready, Gridley." Note the boarding pikes on the hammock nettings. The remains of the steam pipe which was to be used to repel boarders is still visible.

The Government *of* Japan

By LIEUTENANT COMMANDER RALPH S. WENTWORTH, *U. S. Navy*

THE story of the government of Japan is of interest and of importance to every United States naval officer. When it is realized that the Kuriles are but a short plane flight from the Aleutian Islands; that on a clear day southern Formosa can be seen from the northernmost Philippines; that this great sea power lies across the pathway of the United States to the markets of the Orient, as yet undeveloped but promising; and that she is placed on the flank, no, on the path, to the Philippines with her Class "C" mandates, it is clear at once that not only Japanese policies but also the manner in which she governs herself is of the greatest importance to the United States Navy.

Since the time of Caleb Cushing in China, the United States has been developing consistent policies in the Far East. These policies have often seemed to be at variance with those of Japan in regard to China.

It is for these reasons that the study of the government of Japan becomes of interest. It is well to know what the history of this government has been, how it has developed, and in what further direction it is evolving, to understand the manner in which the power of the state can give expression to the policies upon which her political leaders may decide.

The twelfth century marked the rise to supreme power in Japan of the Minamoto family in the person of Yoritomo as Shogun or Great General. The assumption of this title marked also the beginning of the loss of temporal power of the emperor, who was restricted more and more in his control of the state. Thereafter, a number of families successively controlled the shogunate. About three hundred years ago the Tokugawa family thrust all others aside and secured the first office to themselves. They were more successful than their predecessors in consolidating the government into their own hands. The previous shoguns had governed about one-half of the country but this great family gradually brought the powerful clans under their control until the country might be said to be a unit. The clan was a group of people of all classes, not necessarily related as to blood but bound together by ties of residence, clan spirit, and custom.

It is true that the control of the shogun was nominal because the *daimios* or chiefs of the clans were independent and impatient of curb. The constant interclan warfare ceased however. Under these peaceful conditions, the shoguns, like the imperial court, became weak. The *daimios* followed suit. The actual power was wielded by a group of younger men who were advised by a council of elders. This was particularly true of the clan government and it even became the rule in the shogunate. The elders or *genro,* as they were called, were too old to fight but old enough to be wise. The younger men were fighters and were called *samurai.* They formed the aggressive oligarchical group in control of the clan and later of the shogunate.

As has been said, towards the latter part of the Tokugawa régime the shogunate became weak. The clans, however, passed through a period of weakness and began to regain their strength. The struggle between the shogunate and the clans was renewed, but this time politically. Several important factors influenced the fight between these two forces.

In 1842 England acquired Hong Kong as the result of the Opium War. In 1855 Russia obtained the maritime provinces. France occupied Saigon in 1859. Perry forced the treaty opening Japan to commerce in 1854. The other powers were not slow to follow suit. In fact the warships of the three European powers had invaded the Japanese waters before 1845 and finally

had attacked the Straits of Shimonoseki in 1863, which were guarded by the powerful Satsuma clan. More than a generation before this period, the Monroe Doctrine had closed the doors of South America to colonization and the European nations had been forced to turn eastward. The signature of these commercial treaties precipitated a controversy between the clans and the shogun in which England espoused the side of the clansmen and France that of the shogun. Some of the leaders on both sides now began to be alarmed and foresaw that Japan was in danger of becoming as helpless, before the demands of these barbarians, as China.

During the latter part of the Tokugawa rule, a body of wealthy merchants had grown up, who wished to do away with the isolation policy and throw open the country to trade. These men were on the side of the clans, not because they favored the change in masters, but because they thought that the return to power of the emperor would bring with it a more liberal trade policy.

Prior to the resumption of the struggle between the clans and the shogun, that is to say in the early part of the nineteenth century, a chauvinistic cult had been formed by a Choshu fanatic by the name of Yoshida Shoin. It was really a revival of pure Shinto. At any rate it grew in numbers of devoted followers and in influence until the government took notice of it by executing its leader in 1859. The man preached restoration, or return of temporal power to the emperor. In addition he advocated a greater Japan by the acquisition of Formosa, Korea, and territory on the mainland of Asia. His book was widely read. But he was just ten years ahead of his time as far as restoration was concerned, and a half century in his imperialistic policies. However, the cult made a deep impression on the Japanese nation which had long considered the emperor as a divine descendant of the Sun Goddess and fit to rule.

The old emperor was gathered now to his ancestors and the new ascended the throne. He gave promise of great ability although his education was not suited to the coming conditions. It consisted mainly in a thorough knowledge of Chinese classics. Still many a man has made an excellent king who was unable to do more than scribble his name. This young man was destined to lead his people out of the darkness into the light. Hence the period of his reign is known as the *Meiji* era or "age of enlightenment."

All these factors made the position of the clans, in demanding the return of the power to the emperor, strong. The two leading clans were the Satsuma and the Choshu, then as now, the strongest forces in the land. The former desired the restoration, not so much for the sake of the neglected emperor, as in the hope that a shogunate would be necessary again, and in such a case, the Satsuma clan would provide the great general. It was a political move.

The infamous and inferior conditions of the trade treaties wounded the pride of this proud people and further undermined the position of the Tokugawa shogunate. It fell or shall it be said, it withdrew, in 1869. Let it be noted here that this illustrious old family was patriotic enough to relinquish the office without a civil war. The nation was enabled thus to turn to the task before it without the arresting scourge of a civil war. The emperor reigned, at last, after seven hundred years.

Upon the assumption of power by the emperor the two allies, Satsuma and Choshu, disagreed in regard to the method of government. The Satsuma group desired a return to the prefeudal government while the Choshu wished a government of bureaus much like that of the ninth and tenth centuries. Choshu won.

The mass of the people were non-existent politically. The first years of the monarchy saw the rise to power of the young *samurai* who had brought about the restoration. They were members of the Satsuma and Choshu clans, in the main, although one or two of the minor clans were represented. Three of these men had spent a short time abroad and had acquired some idea of the conditions of the times. Perhaps the leading one was Ito who soon formed a peace party and gained control of the government. He seemed to realize the tremendous work before the country and felt that Japan needed peace in which to accomplish it. He was opposed by a fighting party led by Saigo. A definite issue arose in regard to the military occupation of Korea as a punishment for a fancied insult. Civil war ensued but Ito was ready for it and the rebel-

lion ended with the death of Saigo and the complete defeat of an army of *samurai* by one of ordinary citizens. Ito was now free to carry out his plans.

The seventies were busy years. Abroad the government was attempting to remove the restrictions and regain the rights which had been signed away in the treaties with the great powers. At home, twelve thousand elementary schools had been started by 1872 in an effort to prepare the people for the new civilized era and for a measure of self government. The clans were abolished and the country was divided into districts called prefectures. The governors of these prefectures were appointed by the central government and so were the advisory councils, at first. Later the councils were elected by a restricted electorate. Other reforms followed during these full years.

Many leaders did not believe in representative government; but a majority apparently favored a very limited form of self government. Some few others supported the latter group because they saw in representative government the only check to clan control. Thus a sort of liberal movement began to make itself felt. In 1881, the emperor issued an edict promising a constitution in ten years' time.

The following year Ito and a selected party began a tour of America and Europe to study constitutional government. In Germany he met Bismarck, then Chancellor and at the height of his power. The Prussian system of monarchy resembled that which was traditional in Japan. Bismarck had a compromise between autocracy and popular government which looked to Ito like that for which he had been searching. Accordingly, Prussia and the Imperial German Empire were the models which were used in drafting the constitution and many of the commercial laws of Japan. The criminal law is founded upon that of France.

The Japanese leaders desired to avoid "responsible" government such as that of England. The British system was in direct contradiction to the cherished belief of divine descent and unbroken lineage of the royal line of Japan. These leaders wished a continuance of power because they believed it to be for the good of the country. The subject of government by the people *vs.* oligarchy was threshed out. The president of the Imperial University of Tokyo proved that man had no natural rights and, therefore, the whole question of where sovereignty rested, was not one of principle but of expediency. Believing that the great mass of the people were still too ignorant to govern themselves, desiring power for its own sake, and, finally, because of the divinity and infallability of the emperor, the *samurai* of the great western clans, into whose hands the power had fallen with the restoration of 1868-69, easily persuaded themselves that a continuation was necessary although under another form.

At any rate, Ito returned from his travels in 1883 with the "Golden Fleece." The transformation began with the selection of a hand-picked committee favorable to Ito's ideas.

The following year, the nobility of five orders of peers was constituted in accordance with the Prussian system—princes, marquises, counts, viscounts, and barons. Here was the source of the greater part of the membership of the upper house of peers in the bicameral system which was to be established.

In 1885 a cabinet was formed. Its membership included a minister-president and the heads of nine administrative departments. Rules for the conduct of affairs by this cabinet were decreed by the emperor. The latter, personifying the rights of sovereignty by reason of his direct descent from the gods, appeared as a personal despot. He exercised his powers in accordance with the advice of the cabinet, through the members of a bureaucracy entrusted with the routine of governing. However, he was not forced to govern in such a manner since he was the actual sovereign.

Three years later an imperial ordinance established a privy council. Ito now resigned his office as minister-president of the cabinet to become the president of the new body which was to consider the draft of the new constitution. The council, in the utmost secrecy, examined and formally promulgated the new constitution without the assistance, as far as is known, of the emperor and certainly without allowing the people or representatives of the people to have a voice in the matter. Indeed, of the nine million adult males at that time, but one hundred thousand belonged to political societies.

In such a manner the written constitution

of the empire of the Rising Sun was formed. The first diet was elected and met in 1890.

The first chapter of this constitution contains seventeen articles only one of which was of native origin. It is the first and reads: "The empire of Japan shall be reigned over and governed by a line of emperors, unbroken for ages eternal." The article correctly and concisely states the Japanese system of monarchy. All the other articles, except the eighth, were copied from chapter three of the Prussian constitution. Article eight, in briefer and more absolute form, is section fourteen of the Austrian fundamental law on imperial representation.

In view of the fact that the powers, which are not given to the diet explicitly or by necessary inference, are reserved to the emperor, any compilation of them must of necessity be incomplete. Only time and circumstance can develop them in their entirety. But one thing is certain. The limitation of the exercise of rights of the emperor by the consent of the diet is expressly set forth in the constitution. Hence, it may be said that the emperor knows what he must not do but he does not know what he may do. Article four states: "The emperor is the head of the empire, combining in himself the rights of sovereignty and exercising them according to the provisions of the present constitution."

These rights of sovereignty are divided into three classes: (1) those reserved solely to the emperor, (2) those reserved to him with the consent of the diet, and (3) those in which he will not interfere.

The sovereign orders the laws passed by the diet to be issued and enforced. He is not required to issue or to enforce the laws but does so in his own discretion. He convokes, opens, and prorogues the diet. The lower house can be dissolved by him and he has not hesitated to do so on numerous occasions. Indeed, the diet, as the lower house is generally called, has probably been dissolved more times during its few years of work than the similar body of any civilized nation in a like period of years. If the diet as a whole passes any law which is unsatisfactory to the emperor, he can veto it and there is no recourse open to the diet but acquiescence. In the past, the emperor, on several occasions, has ordered the diet to comply with his wishes. Such is the veneration with which he is held, that an indication of his desires is sufficient. The appointment and dismissal of all civil and military officers is his prerogative. He alone determines the organization of the different branches of the government. The emperor is the supreme commander of the army and navy. He declares war, makes peace, and concludes treaties. It is not necessary nor customary to submit treaties to the diet for ratification unless they entail a new demand for money. In this case the actual treaty is not submitted but the necessity for the new expenditure appears in the next budget which is sent to the diet. The emperor proclaims a "state of siege." He directs the grants of amnesty, pardon, or rehabilitation. It is clear that the power of this sovereign is more absolute than that of any other head of a great nation. Furthermore, it is certain that the use of these powers, through the cabinet, enables the weight and strength of this nation to be concentrated rapidly and effectively in crises.

Under the second heading, the emperor exercises legislative power with the consent of the diet and house of peers. When the legislative body is not in session, decrees or ordinances are issued but these must be submitted to the diet at the next session. However, there is seldom any trouble in this regard. Perhaps one of the greatest limitations to his power is the necessity to get an authorization from the diet to make available funds for new projects and new taxes. This does not embarrass the government greatly as will be shown in the discussion of the diet.

The judiciary are given the power to judge according to the constitution and the law in the name of the emperor. This is the last division and it is the only one in which the emperor does not interfere.

The cabinet is mentioned in the constitution in one article, the fifty-fifth. This article reads: "The respective ministers of state shall give their advice to the emperor and be responsible for it." They are answerable to the emperor only and not to the diet. In fact, many adverse votes have been passed by the diet without affecting the life of the cabinet. They are further responsible to the emperor for all laws, ordinances, and rescripts. To obtain an idea of their duties, responsibilities, and rights, it is necessary to go back to a group of im-

perial ordinances issued in 1885-86. Here they are empowered to issue departmental ordinances. Department heads send to the cabinet drafts of new laws which pertain to their particular department. The delegation to their subordinates of numerous duties is allowed except the counter signature of laws, personal reports to the emperor, voting at cabinet meetings, and issue of departmental ordinances. Now the consent of the diet is necessary to the passage of a law; but the cabinet remains the chief initiator of bills to be brought before the diet. Such bills have the right of way unless the government agrees to a delay. They can be withdrawn at any time. The cabinet has access to either house even though they are not members. They may attend committee meetings and may speak if the floor is not occupied. The control of legislation by the cabinet in every phase is apparent and real.

The government of Japan is largely a bureaucracy with all the red tape and power of that type of government, augmented and quickened by the power of the emperor.

An imperial ordinance of 1888, creating the privy council, stated that "though the privy council is the emperor's highest resort of council, it shall not interfere with the executive." It is an advisory body and its influence depends entirely upon the strength of the members and the faith of the emperor in its good judgment. In the first years of the new government and up to about 1925, its functions were somewhat overshadowed by the greater influence of the *genro*.

It will be remembered that every clan and even the later shogunates had their *genros* or group of wise old men who advised. In a like manner, the late emperor obtained the advice of the *samurai* when they grew older and had given up the direct care of the state. These men came to have great influence. Perhaps it would be more accurate to say that, after they had exercised the powers of government as cabinet ministers, they were so used to it that they continued to control matters when they became the *genro*. It is certain that no important matters, such as war, treaties, diplomatic notes, or changes of cabinet were decided without their advice and, generally, their decision. They did not mix in political quarrels but kept aloof from such small matters. It is noticeable that they procured the appointment of Satsuma and Choshu men for the great posts of the empire for years and years. If at times an outsider was given an important post, such as Okuma at the time of the twenty-one demands, it was because of the scandals in naval administration and the ready acquiescence of Okuma to their policies. Gradually, however, they have passed away and but one remains, Prince Yamagata, who was recently consulted by the emperor in the change in the premiership. The secret of their power over the cabinet lies in many things such as prestige, as founders of the empire, having the ear of the emperor, and so on. But they have one means which never fails. By imperial decree, the posts of ministers of War and Navy are filled by general officers and flag officers. If the ministers of these two portfolios resign and no one can be found to accept the vacant places, the cabinet falls. In this manner these wise old men always have a trump ready for emergencies. With the death of the remaining member of the *genro*, the institution familiar to all clansmen will pass away and the emperor will govern through his council and cabinet, unless a new *genro* arises.

The Japanese legislature is of the bicameral type and consists of the usual house of peers and the lower house, called the diet. The personnel of the upper house contains members of the royal family, nobles of the five orders who have been elected thereto by their respective orders, persons nominated by the emperor for meritorious service, one member from each county nominated by the largest taxpayers and who has been appointed by the emperor. The age limit for the royal family is eighteen, for peers twenty-five, and for the remainder thirty-five. The length of the term for all members, except royalty, is seven years, a decided change from the custom of other houses of peers. In 1925 the house contained 150 peers, 125 imperial nominees, 66 taxpayers, and 4 members of the imperial academy, a total of 345. The royal members are included in the peers. It is seen that the upper house is distinctly aristocratic and that it is controlled absolutely by the emperor. The two houses exercise identical powers in regard to legislation. The peers have little sympathy with the democratic ideas of the diet and this

explains the constant support which they have accorded the cabinet, the success of the cabinets in the face of violent opposition in the diet, and, finally, the thwarting of the lower house in its persistent attempts to secure a democratic government.

The diet is elected, under the new universal manhood suffrage bill, by an electorate consisting of all the males who are twenty-five years of age and who are permanent residents of the district in which they vote. The qualifications for a candidate are that he must be thirty years of age and be able to vote; but he cannot be a priest, school teacher, government contractor, election officer (in the district in which he runs), officer of the imperial household, revenue or police officer, soldier, sailor, bankrupt, incompetent, head of a noble family, or a student—a rather extensive exception. The representation is by districts; one member is allowed to every 130,000 population.

The legal powers of the house of peers and the diet were assigned them by imperial decrees in 1889-90. Briefly they are that every law requires the consent of the diet; either house can initiate bills; both houses shall vote on cabinet bills; each house may adopt its own rules of procedure, providing they are not at variance with some imperial law; the members are generally free from arrest except in flagrant cases; and they are not responsible civilly for opinions or votes in session. The actual powers of the diet are limited because the cabinet is not responsible to it but to the emperor. Indeed the cabinet can suspend sittings of the diet for fifteen days and the emperor can dissolve it. This means an undesirable, heavy expense to the members for a new campaign. Needless to say, the dissolution of the diet is not popular.

Although either house can initiate bills, in real life they seldom do. Often the only bills introduced are those of the government, which generally have to do with budget and taxes.

Like Imperial Germany, if the budget is not voted, by constitutional law the budget for the previous year is reapplied. It is true that when the budget fails to pass there is some difficulty, particularly when new and expensive projects are already undertaken in advance of the diet's approval of expenditure. But even then matters are not desperate, since the cabinet always has rather large sums available which do not come under the budget. The sixty-seventh article of the constitution exempts from the competence of the diet, either to reject or to reduce without consent of the cabinet, all expenditures involved in the exercise of the imperial prerogative, such as salaries of military and civil officials, departmental expenses, expenses on account of the army and navy, the gendarmes or militia, and expenses arising out of treaties. In addition, all expenditures which may have arisen by effect of law or which concern the legal obligation of the government are exempt. The list not subject to diet control tends to lengthen year by year. If the diet in one year grants an increase for an extra division of infantry for instance, the amount thereafter appears in the annual budget as a regular expenditure and cannot be taken away without the consent of the government. The feeble grip of the diet on the purse strings is only sufficient to enable it to prevent the government from expending large sums on some new project. However, these generally pass when they have to do with some military plans, because of the strength of the military in Japan. If the diet cannot control expenditures, there are numerous instances where it has halted such projects as tax bills, election laws, and enforcement of civil codes. This has been accomplished by criticism, obstruction, and even actual violence. Not so long ago (1913) a mob was incited in Tokyo to attack the homes of government supporters. The government can neither increase taxes, lay new taxes, nor float loans without the consent of the diet. The power of the lower house over even those is not absolute, since the emperor can order compliance or dissolve the diet. Besides, the cabinet can generally secure the support of one or more parties. It may cost an important post or even a few bribes well placed, but the law will finally be enacted.

Public opinion is growing with the education of the people. The diet is beginning to feel the support of the masses and, with this backing, the government has been forced occasionally to comply with its wishes. Even so the cabinet has always the loyalty of the people to the emperor available. It is only necessary to indicate the wishes of the emperor and all is cleared for the passage of a measure. If the diet wishes to

petition the emperor, it must be done by address, with the approval of the majority.

The diet may pass a bill but there is no law which requires the bill to be enforced and applied. The execution of laws is the sole prerogative of the emperor. When the enforcement requires money, the cabinet must ask for money for the purpose or the law is dormant. Thus the Factory Act of 1910 was not put into effect until 1916 because the government did not choose to ask for the necessary money.

The diet is allowed by law to meet once a year for a ninety-day session. It has been customary in the past to call the session for December 20, rise for the New Year, and reconvene a month later. This leaves but two months. Should the cabinet suspend sittings for fifteen days, six weeks remain. Plenary sessions are held every other day and last about three hours.

Members of either house may interrogate the ministers, except those for the army and navy. The ministers may reply or not as they wish. In the latter case they must give their reasons in writing for declining to reply.

Modification of the constitution can be effected when it is submitted by imperial order to the diet. It cannot be initiated in the legislature. For ratification, two-thirds of the members must be present in each house and two-thirds of those present must vote in the affirmative. The houses vote separately.

No modification of the imperial house law shall be submitted to the diet, says article seventy-four. There is then no opportunity for the diet to determine the line of succession to the throne as has been done in English history several times.

The parties in Japan are not founded upon principles but on personalities. Some of the *samurai* who brought about the restoration are responsible for the two largest. Several smaller ones have sprung up since the establishment of the two older, the Seiyukai and Deshikai. The platforms of the larger are much alike while the smaller ones tend toward the labor point of view. The parties have found that it generally pays to support the government. Besides, the government controls the gendarmerie who supervise the elections. Both of the large parties seem to be anxious to support the government. The opposition is composed of the small fry and the larger party out of favor. No mention has been made of the Satsuma-Choshu party. It is really not a political party but a clanish perennial party. This Sat-Cho group have controlled matters for years through their leaders in the cabinet, the privy council, and the *genro*. At first the military from these two clans were the dominant party. Although the military faction is still strong, the Sat-Cho combination have allied themselves by marriage with the great financial and business houses. They still make their influence felt in the diet and in the government.

Article sixty-one of the constitution provides that no suits at law, which relate to the rights of the citizens, alleged to have been infringed by the measures of the executive authorities shall be taken cognizance of by a court of civil law. Such suits shall be judged by courts of administrative law.

All Japanese are liable to taxes and military service. Subject to restrictions placed by the law, they have equal rights to appointment to civil office. An examination is required. They can change their abode freely; their houses cannot be searched; they enjoy freedom of speech, public assembly, writing, association, and religion. They can be arrested only according to law and must be tried by judges. Juries are unknown. Their property is inviolate. These rights are subject to the restrictions placed by law, and can be curtailed in times of emergency. There is a compulsory educational law.

It is apparent from the foregoing that the government of Japan can be classed only under the oligarchical type. It is so ordered as to give the Japanese citizen complete liberty but little power. Like the Reichstag of other days, the diet could be called a glorified debating society.

From the beginning of the present form of government in Japan in 1890, the sessions of the diet have been notable for the constant and bitter opposition which the popular house has shown toward the government of the day. This continual uproar was only stilled into a temporary calm during the Sino-Japanese and Russo-Japanese wars when all parties and every citizen united to support the government in loyalty to the emperor. Except for these two short periods of national peril, the yearly meetings of the lower house have indicated clearly the de-

sire of the masses to control the government and, on the other hand, the determination of the elder statesmen to continue the oligarchical government. The *genro* and their followers, through the utilization of the best brains of the empire culled by civil service examinations and wise policies of prosperity at home and security abroad, have been able to overwhelm the efforts of the liberals. The *genro* were aided in this by lack of interest of the masses, who felt, and justly so, that the fight was merely between different factions of the same class and, therefore, no concern of theirs.

The years passed by. Education became more universal. Okuma and the liberals were able to make themselves heard more often. A class of merchants, educated, business like, and liberal, came to the aid of the lowly liberals. The business of the nation grew with and as the result of the fruition of the plans of the leaders to westernize the entire country—in a word to commercialize it. Many leaders realized that Japan, without raw materials, must industrialize like England, or remain a second-rate power. These business men, like others of a different nationality but in a similar island empire, became the democratic backbone of the liberal movement. Numerous measures were forced on an unwilling government by public opinion, such as the universal manhood suffrage bill. The percentage of illiteracy is one of the lowest of any civilized country in the world. The taste of the reading public—and over half the families throughout Japan take a daily paper—is essentially serious. Many articles of a thinking type are printed, such as bicameral system of government, decay of civilization, and the socialism of Karl Marx. The widespread popularity of this kind of reading indicates a quickening interest in government and its problems by the everyday man. During the latter part of the World War there was apparent a tendency in some quarters towards radicalism of a communist type, probably fostered by its agents. But after the earthquake common sense returned to the Japanese and all realized that work and work alone would make a great nation of Japan. Radicalism was not the answer. There still remains, however, an increasing liberal and also a growing socialistic party. In the last few years, the farmers have begun to advance their grievances which, like farmers elsewhere, result from the high cost of living. Some 67 per cent of the people belong to this class and an attempt is being made to organize them. The result of all these various movements and tendencies is to strengthen the growing liberal party. Although the cabinet is still responsible to the emperor, one fell recently through "loss of face," following adverse public opinion. It is seen that even oligarchical governments feel the rising tide of public opinion and respond to it in some degree. But the old order passes away naturally with the death of the *genro*. The power of the Sat-Cho group does not weaken quite so easily. In recent years, particularly during the war and afterwards, big business began to take an interest in government and legislation. It is said that business has followed the western policy of subsidizing certain prominent members of the diet and even of the cabinet and departments. Many large business concerns are owned in part by an interested government. The royal family has invested heavily. Not long ago, it was charged that big business attempted to make sugar a monopoly through wholesale bribery of diet members. Be that as it may, much intermarriage of business families and the powerful Sat-Cho group has occurred. In the present and coming stage it cannot be said that the Sat-Cho alliance has lost all power, although it may be changed somewhat by the addition of other policies, notably those of business.

A careful estimation of these various factors indicates that Japan is gradually moving towards a more democratic form of government. But, in view of the policies of business men elsewhere in the past, it is by no means certain that this new government, as it is changed gradually, will be any the less imperialistic than the old, except insofar as good business demands a more conciliatory attitude.

Dr. McLaren has stated in a recent article:

> There will arise a long succession of difficult problems demanding solution, but with a government resting upon the support of a politically free people led by a monarch, loyalty to whom is an article of faith, no problem need be feared. With its manhood preserved and developed by the free exercise of its facilities in all directions, no nation need dread what the future has in store.

The Merchant Marine Reserve Versus *the* U. S. Fleet Reserve

By LIEUTENANT COMMANDER JULIUS KATTERFIELD, *U. S. Naval Reserve*

THE World War demonstrated the absolute necessity of having available a body of trained men to augment the fleet personnel in a national emergency.

The reserves available in 1917 consisted of the Naval Militia, volunteers, and last, but not least, of men enrolled or commissioned from the seagoing population of the country.

It is interesting to compare our naval reserve with that of the other belligerents, especially Great Britain. The British Navy depended for their first-line reserve entirely on the seagoing population. These officers and men served on combatant as well as auxiliary vessels, and performed their duties, owing to their training in the reserve, without decreasing the efficiency of the various units to any marked extent. The non-seagoing contingent of the British Naval Reserve (the so-called wavy-navy, because the officers wore wavy stripes) was used chiefly for administrative duty.

In our service, many reserve officers were assigned to combatant ships during the World War. In cases where the officer concerned had no other training but that of the state militia, he was often (especially where he held rank above that of ensign) unable to perform his duty adequately, and automatically assumed a training status, becoming for the time being a liability instead of an asset to the Navy. The same criticism, but to a far lesser extent, applied to the officer who had been a master, mate, or engineer in the merchant marine. The ways of a man o'war were new and strange to him, but since he knew the sea and life aboard ship, men of this type adapted themselves to their environment in far less time than their shore-going shipmates.

Today we have the Fleet Reserve, the Merchant Marine Reserve, and the Volunteer Reserve. The training in the Fleet and Volunteer Reserve is more comprehensive than that of the former state militia, but the practical sea training (fifteen days yearly) falls far short of the requirements. On the other hand, we have excellent material in the Merchant Marine Reserve. This body of men could, with the necessary training, be developed to the point where auxiliary cruisers, converted yachts, etc., could be manned entirely by reserves, under command of a regular officer. It would seem more to the purpose to spend funds available in training men who already are well versed in seamanship, navigation, and marine engineering, rather than train shore-going people who still have everything to learn about the Navy.

By changing the Merchant Marine Reserve to the Fleet Reserve, and designating the present Fleet Reserve the Volunteer Reserve, transferring out of the latter all former regular Navy men and men who served at sea during the war, the Navy could develop a first-line reserve consisting of men already highly trained in seamanship, navigation, and steam engineering. The Volunteer Reserve, consisting largely of professional men, could be used for shore and administrative duty.

It remains to provide proper training for the merchant marine men. Instruction in their case should be concentrated on such subjects as gunnery, naval regulations and customs, infantry drill, and signaling. Perhaps the British system of training naval reservists could be successfully adopted by our Navy, with a few changes to meet our special conditions.

An obsolete gunboat or small cruiser (one on each coast), could be fitted out with a modern secondary battery and manned with a selected skeleton crew. This vessel would

be used as a special training vessel for reservists. In about three months of rigorous training, officers that had passed a strict educational examination could acquire enough training to meet the requirements of a reserve officer in all but capital ships, modern cruisers, and submarines.

The necessary incentive to induce men to take this training could be supplied by giving preference to trained reservists in manning the fast modern liners now being constructed with government aid. If the experience of the British Naval Reserve officers counts for anything, it will be found that steamship companies will be anxious to bid for the services of these trained officers, because they are reserve officers should be a guaranty of superior professional ability, education, and moral worth.

Congress should be made to realize that the appropriation necessary for this project would result in greater security for our country, without increasing the regular Navy, and also in lifting the standard of the American merchant marine to a higher level.

Concerning *the* Piezo-Electric Effect

By Professor William H. Crew
Department of Physics, New York University

Time glides with undiscover'd haste,
The future but a length behind the past.
—Dryden

TIME is a curious, droll fellow, unwilling to be hastened or retarded in his steady tread through the ages; a being apparently without mass yet possessing infinite inertia; undetectable by any of our senses, yet ever present in our consciousness. Unmindful of space or matter, on he glides hand in hand with Past, leading the way, and Future, following but a length behind. But, in this day of numerous time-saving devices, may not Future soon overtake Past and lead this merry trio in their undiscovered haste?

To this question past experience answers, "No!" After Hero of Alexandria used the motive power of heat to open the doors of his temple, how many centuries passed before man applied this form of power to useful purposes? For how many generations did man look from his window to see 20,000 amperes of electric current illuminate the entire heavens in a single flash of lightning before his own home was equipped with electric lights? How long will *we* sit on our verandas and watch the gentle firefly with his nearly perfect light-giving torch, while within we pay for energy which floods our parlors with invisible radiations and a paltry few which actually provide illumination? In truth, still does the future—yea, even the present—glide a length behind the past.

It was with the utmost reluctance that navies of a century ago allowed steam power to replace the use of sails in their war craft; but now, with the diplomatic limitation of quantity of naval power, unprecedented efforts are being made to improve the quality of floating armaments through application of knowledge. Where the economic burden bears heavily enough, a solution will be found to fulfill a need; indeed, witness the enormous improvement, in but a few years' time, in the quality of phonographic reproduction when that trade was economically pushed by the practice of radio broadcasting. Without the stimulus of an urgent need to be fulfilled, years, and even centuries, often pass between the conception and application of physical facts.

A phenomenon known as the "piezo-electric effect" remained not much more than a recorded fact for nearly forty years after its discovery; but under the stimulus of the World War investigators reconsidered this effect and commenced a study of its possible applications to practical purposes. In England Sir J. J. Thomson[1] showed how it could be used to measure pressure changes during the discharge of a gun; in France, Professor P. Langevin[2] used it in a device for detecting submarines and for making deep-sea soundings; in Canada, Dr. R. W. Boyle[3] applied it to a means of feeling out the presence of icebergs in foggy weather; and in the United States, Drs. Pierce[4] and Cady[5] found for it a use in improving radio communication.

At the present time many commercial and private research laboratories have men investigating the piezo-electric effect and de-

[1] Thomson; *Engineering;* 107, 543 (1919).
[2] Langevin; *Handbuch der Physik;* 8, 335 (ed. 1929).
[3] Boyle and Reid; *Transactions of the Royal Society of Canada;* 20, 3, p. 233 (1926).
[4] Pierce; *Proceedings of the American Academy of Arts and Sciences;* 59, 81 (1923).
[5] Cady; *Proceedings of the Institute of Radio Engineers;* 10, 83, (1922); also *Journal of the Optical Society of America;* 10, 475 (1925).

veloping its applications. What is the piezo-electric effect?

THE EFFECT

It is recorded in a pamphlet entitled "Curious Speculations on Sleepless Nights," written in 1703 by a Dutch jeweler, that certain crystalline substances when heated exhibit electrical charges on their surfaces —a phenomenon which has since acquired the name of "pyro-electric effect."

More than a century and a half later, in 1880, two brothers, Jacques and Pierre Curie,[6] discovered an analogous effect, in which positive and negative charges appear on the faces of certain crystalline substances when they are subjected to pressure. This *pressure-electric* effect is now commonly referred to as the piezo-electric effect.[7]

The discovery of the Curies was, in brief, this: a slab of tourmaline was clamped between two copper plate electrodes which were connected to an electrometer. When the tourmaline was compressed more firmly between the electrodes a deflection of the electrometer needle was observed, indicating that the electrodes had become charged, one positively and the other negatively. Furthermore, it was found that a corresponding lessening of the compression of the slab generated equal charges but of reversed polarity.

A few years later they discovered an effect which was just the reverse of this piezo-electric effect, namely, that when a potential difference was applied to the electrodes of the tourmaline crystal the latter was observed to expand or contract according to the direction of the applied potential. This effect is known as the "inverse piezo-electric effect." These phenomena were very carefully studied by the brothers Curie, both experimentally and theoretically, and a beautiful and complete description of their work is to be found in the *Oeuvres de P. Curie.*

A number of substances other than tourmaline show these effects, principally Rochelle salt and quartz. In Rochelle salt crystals the piezo-electric effect is very marked, but the deliquescent nature of this substance makes it unsuitable for practical purposes.

[6] Pierre Curie was the eminent French physicist who, working jointly with his wife, first succeeded in separating radium from uranium ore.

[7] "Piezo" is from the Greek πιέζειν meaning "to press."

In the case of quartz, though the effect is considerably smaller, its rugged and permanent nature makes it most desirable for experimental and practical application. In the discussion that is to follow, therefore, we will confine our attention only to quartz, remembering, however, that these same phenomena appear in a number of other substances.

When quarried from its natural state, quartz generally appears in odd and irregular chunks of semitransparent, glass-like material; but occasionally large and complete crystals of quartz are to be found which have a beautiful and regular hexagonal form, and vary in length from a few inches to sometimes more than a foot. Quartz consists of molecules of silicon dioxide which, by a natural process of chemical deposition, have congregated in such a manner as to form hexagonal crystals. By accumulating molecules the crystal grows, but it may acquire them in either of two distinct manners and accordingly one finds in nature two kinds of quartz, called "right-handed" and "left-handed" quartz. Sometimes within a single crystal one finds both kinds of quartz indiscriminately mixed, a circumstance which is completely ruinous to the piezo-electric properties of such a crystal.

To the unaided eye right-handed and left-handed quartz look identical but the optical property known as the rotation of the plane of polarization is exactly opposite in the two cases, and by means of a polariscope it is possible to distinguish between specimens of right-handed and left-handed quartz and those which are a mixture of each.

Let us imagine that we have at hand a perfect quartz crystal. Its middle portion will be a six-sided prism, much like the shank of a lead pencil, and its two ends will be hexagonal pyramids, similar to the sharpened end of a lead pencil. The axis drawn through the pointed ends of such a crystal is known as the optical axis; and those drawn perpendicular to the six faces of the crystal as well as those bisecting the six dihedral angles of the crystal are known as electrical axes. However, since these electrical axes coincide in pairs, there are actually only six of them in quartz. Suppose now we cut a good generous slab from our crystal, making the sections perpendicular

to the optical axis, and then from this slab we cut smaller and thinner slabs, this time making the sections perpendicular to the original cuts. We now have small rectangular slabs as shown in Fig. 1 with faces, let us say, about two inches square and with a thickness of a quarter of an inch and cut so that the axes are as indicated in the figure.

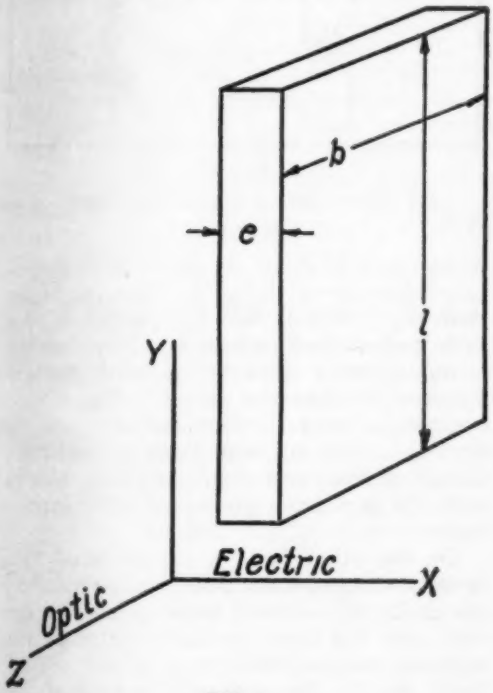


FIG. 1.

Typical piezo-electric crystal slab cut with the short dimensions, *e*, parallel to an electrical axis.

Such a quartz crystal slab shows to the best advantage the direct and inverse piezo-electric effect.

Just why such a crystal slab exhibits electrical charges on its surfaces when it is subjected to pressure is not definitely known, but the facts are these: that an electromotive force between the two broad faces is generated by a pressure exerted on these faces; and that this electromotive force is essentially directly proportional to the pressure.

Certain Practical Applications

This very simple phenomenon lends itself immediately to several useful applications; for example, the method of deep-sea sounding as described by Sir J. J. Thomson.[1] This method consisted in placing a quartz crystal beneath the surface of the water and discharging near by a quantity of explosive which sent a compressional wave through the water in all directions. The direct wave compressed the crystal, produced between its surfaces a potential difference which was recorded upon an oscillograph; and a moment later the portion of the wave emanating from the explosion in a vertical downward direction was reflected from the bottom of the sea and was in turn recorded upon the oscillograph. Since the velocity of these sound waves in water was definitely known, obviously the time interval between the two records on the oscillograph was a measure of the depth of the water. Such a method, however, is a bit clumsy to handle aboard ship and, as will be seen later, a much better application of this same effect is now used for deep-sea sounding.

For the measurement of pressure in guns during their discharge the quartz crystal lends itself particularly well, for the potential difference between its faces follows with scarcely any time lag the variations in pressure to which the crystal is subjected. With the modern cathode-ray oscillograph, it is possible to record on a moving photographic film the rapid variations of potential obtained from the crystal and thus to have a graph of the time variation of pressures within a gun when fired.

Utilizing the inverse piezo-electric effect, two Englishmen, Wynn-Williams[8] and Wood,[9] have used crystals themselves as oscillographs. For this purpose two quartz crystal slabs were cemented together (Fig.

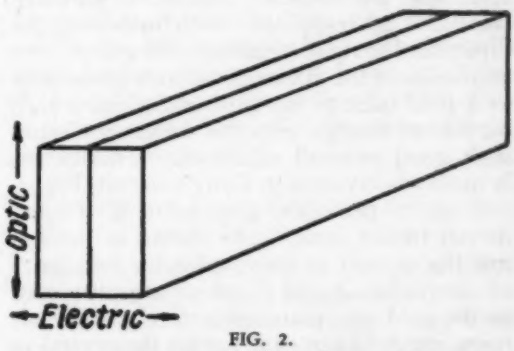


FIG. 2.

Two crystal slabs cemented together for use as a piezo-electric oscillograph.

[8] *Philosophical Magazine* **49**, 289 (1925).
[9] *Philosophical Magazine* **50**, 631 (1925).

2), in such a way that when a potential was applied to their outer surfaces one of the slabs contracted while the other elongated. This contracting of one crystal and expanding of the other produced a bending in the double crystal slab, similar to the bending in a bimetallic thermograph, and the amount of bending was measured by the deflection of a beam of light which was reflected from one of the ends of the slab. In such an apparatus the amount of deflection is then a measure of the applied potential and it can be used for both direct and alternating electromotive forces.

PULSATING CRYSTALS

In recent years the inverse piezo-electric effect under high-frequency alternating potential has come to possess a new interest, for the alternating electromotive forces cause the crystal to expand and contract alternately, in step with the applied E.M.F. As is the case with a pendulum, there is a frequency at which any one crystal slab naturally vibrates or pulsates most readily, and if the driving E.M.F. is tuned to this natural frequency of the crystal the amplitude of the vibrations becomes unusually large and the crystal is then said to resonate. The frequency of resonance of a quartz crystal is dependent only upon its dimensions and the direction of its axes with respect to its faces, for its density and elasticity are practically constant the world over; however, it has been shown by Professor Cady[5] that this frequency may be decreased by loading the crystal with metal rods.

The uses of pulsating crystals in radio technique are twofold; namely, as an oscillator and as resonator—both involving the direct and inverse piezo-electric effect. As an oscillator the crystal functions essentially as a feed-back to the grid and gives a high output of energy into the antenna circuit, with good over-all efficiency. This action is most readily seen in Cady's circuit, Fig. 3, and is, in principle, analogous to a tube-driven tuning fork.[10] As shown in the figure the crystal is provided with two pairs of electrodes, *A* and *B*, which are connected to the grid and plate respectively. The alternating field across *B* causes the crystal to pulsate, and this pulsation, by virtue of the direct piezo-electric effect, produces an alternating E.M.F. in *A*, which is communicated directly to the grid. One might say that the crystal is like the pendulum of a grandfather clock, where one end does the swinging while the other controls the impulse which maintains the oscillations.

[10] Eckhardt, *Journal of the Franklin Institute;* 194, 60, (1922).

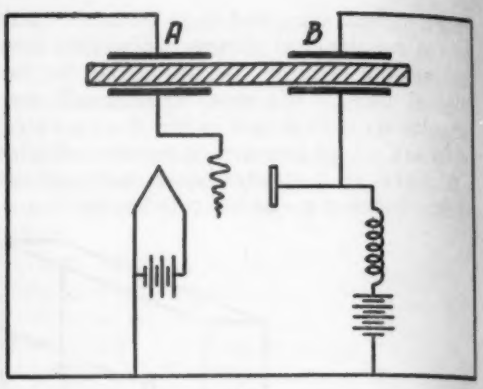


FIG. 3.

Cady's circuit using a piezo-electric crystal as an oscillator.

Crystals used in this manner must be very accurately cut with plane parallel faces devoid of flaws and nicks and operated with surfaces free from grease or other foreign matter.

On the other hand a crystal used as a resonator is generally placed in a secondary circuit loosely coupled to the generator circuit, and the latter is tuned to resonance with the natural frequency of the crystal. Even though the generator circuit should then for some reason change very slightly in frequency, the crystal and the secondary circuit will nevertheless continue to oscillate at the natural frequency of the crystal. Accordingly, if the antenna of a transmitting set be coupled to the secondary of such a circuit as this, it is readily seen that small variations which tend to change the frequency of the generator circuit will not change the frequency of the transmitting circuit.

Such a stabilization of frequency, or wave length, is of the utmost importance in narrowing transmission bands of radio stations, for if one can prevent his radio set from wandering very far to either side of an assigned transmitting wave length, he may utilize then a very narrow wave-length band without fear of trespassing upon adjacent channels. In the practice of transmitting radio signals from airplanes it has been

found that wave lengths vary considerably due to a mechanical jarring and distortion of the radio circuit. In particular, variations in the capacity of the oscillating circuit produce corresponding variations in transmitted wave lengths; but by introducing a quartz crystal resonator it has been found possible to maintain the wave length very nearly constant, thereby assuring better radio contact with planes in flight.

Although in general a crystal has but one fundamental natural frequency of vibration it is nevertheless possible to detect and to utilize some of the harmonic frequencies which bear certain definite frequency relations to the fundamental, just as a vibrating tuning fork is found to emit not only its fundamental frequency but also certain overtones.

Further Use of Pulsating Crystals

The notion of operating oscillating crystals under water in such a manner as to impart high-frequency sound waves to that medium is due to Professor P. Langevin. His ultimate purpose was to detect by means of these waves the presence of enemy submarines which at that time, 1917, were threatening the food supply of France and her allies.

The study of these underwater compressional waves, first produced by this able compatriot of Pierre Curie, has been continued by M. Charles Florisson, engineer for the Societé de Condensation et d'Application Mécanique at Suresnes, resulting in the development of a piezo-electric device which emits vertically downwards from the hull of a ship a beam of ultrasonic waves, and also receives and detects these waves after reflection from the bottom of the sea. With a suitable means for timing the interval between the instants of transmission and reception of a group of these waves, one may readily calculate, by consideration of the known velocity of sound in sea water, the depth of the ocean where such a measurement may be made.

This Societé at Suresnes has equipped many vessels of the Newfoundland fishing fleet with these devices, known as *fathometers,* which not only measure the depth of the sea, but also give some idea of the slope and character of the bottom. With this information at hand skippers of fishing schooners who are well versed in the aquatic habitat and the environmental tastes of the fish can readily discover the most plentiful waters for piscatorial operations, just as the huntsman uses his dog to track the rabbit.

Over a period of a number of years Dr. R. W. Boyle[3] has studied the nature of reflection of these ultrasonic waves. For example, he found that clear and sharply defined echoes were obtained from the bottom of the sea; that depths from a few fathoms to 350 yards, when measured by this means, agreed very closely with those obtained by a Kelvin sounding machine; and that the speed of the ship did not alter the accuracy of the observations.

Using a transmitter which projected a beam of ultrasonic waves in a horizontal direction, Boyle detected echoes from ships, shores, and reefs up to a range of about 1,000 yards; but echoes from icebergs were obtained only up to about 250 yards. In short, he found by direct measurement that granite is about eight times and steel about ten times a better reflector of ultrasonic waves than is ice.

A description of these piezo-electric transmitters, which at the same time serve as receivers, is to be found in other papers[11] by Boyle; but suffice it to say that the surface of a metal disc is driven into vibration by pulsating crystals, and it is from this surface that the waves emanate. Although the disturbances radiate out into hemispherical space, it is nevertheless found that those from certain zones on the circular surface of the metal disc interfere with those from certain other zones in definite directions in space. The result is that waves proceed in a slightly diverging beam of which the axis is perpendicular to the radiating surface; the intensity being small for divergences greater than a few degrees. This is the sonic analogue of diffraction of light through a single slit.

Effects of High-Frequency Sound Waves

In the experiments of Langevin in 1917, it was found that these ultrasonic waves often stunned and sometimes killed fish. This result suggested an interesting field of in-

[11] Boyle; *La Nature;* January 8, 1921. Boyle; *La Nature;* August 20, 1921. Boyle; "Report on Ultrasonics to Canadian Research Council," April, 1922.

vestigation, and in 1927, R. W. Wood and A. L. Loomis published[12] a most interesting and entertaining account of a series of experiments showing various effects of these very high-frequency sound waves on various objects.

Their procedure was to immerse a quartz crystal in a small vessel of oil; when excited by 50,000 volts at 300,000 alternations per second, the crystal vibrated so violently as to cause the free surface of the oil to hump up several inches in the middle and to eject a spray of oil much like a fountain, or a miniature gusher. When a small metal disc was gradually forced downwards in this fountain, alternate levels of maximum and minimum upward pressure on the disc were detected; indicating that the waves traveling upward were reflected downward from the metal disc and consequently set up so-called "standing waves" with their characteristic loops and nodes. Furthermore, various substances immersed in this oil either absorbed or transmitted the energy of these standing waves; for example, a glass rod or tube with one end dipped in the fountain absorbed practically no energy, but at the upper end, where it was gripped between the fingers, enough energy was dissipated in a second to inflict a very uncomfortable burn.

Certain chemical tests indicated that molecular reactions were accelerated when mixtures were subjected to these high-frequency waves; that crystallization of saturated solutions were initiated by them; and that they were capable of liberating dissolved and occluded gases from liquids.

The biological tests by Wood and Loomis were particularly interesting. They found that paramecium were readily killed—in some cases torn apart—by these ultrasonic waves; although some, probably being fortunate enough to be residing in a node, weathered the storm for many seconds. Bacteria, on the other hand, survived any amount of "raying" with the waves, for, it is believed, they are so small that they suffer very little shearing stress, but rather move bodily with the disturbances. It is just so that a small rowboat may ride a sea which would cause a large vessel to buckle.

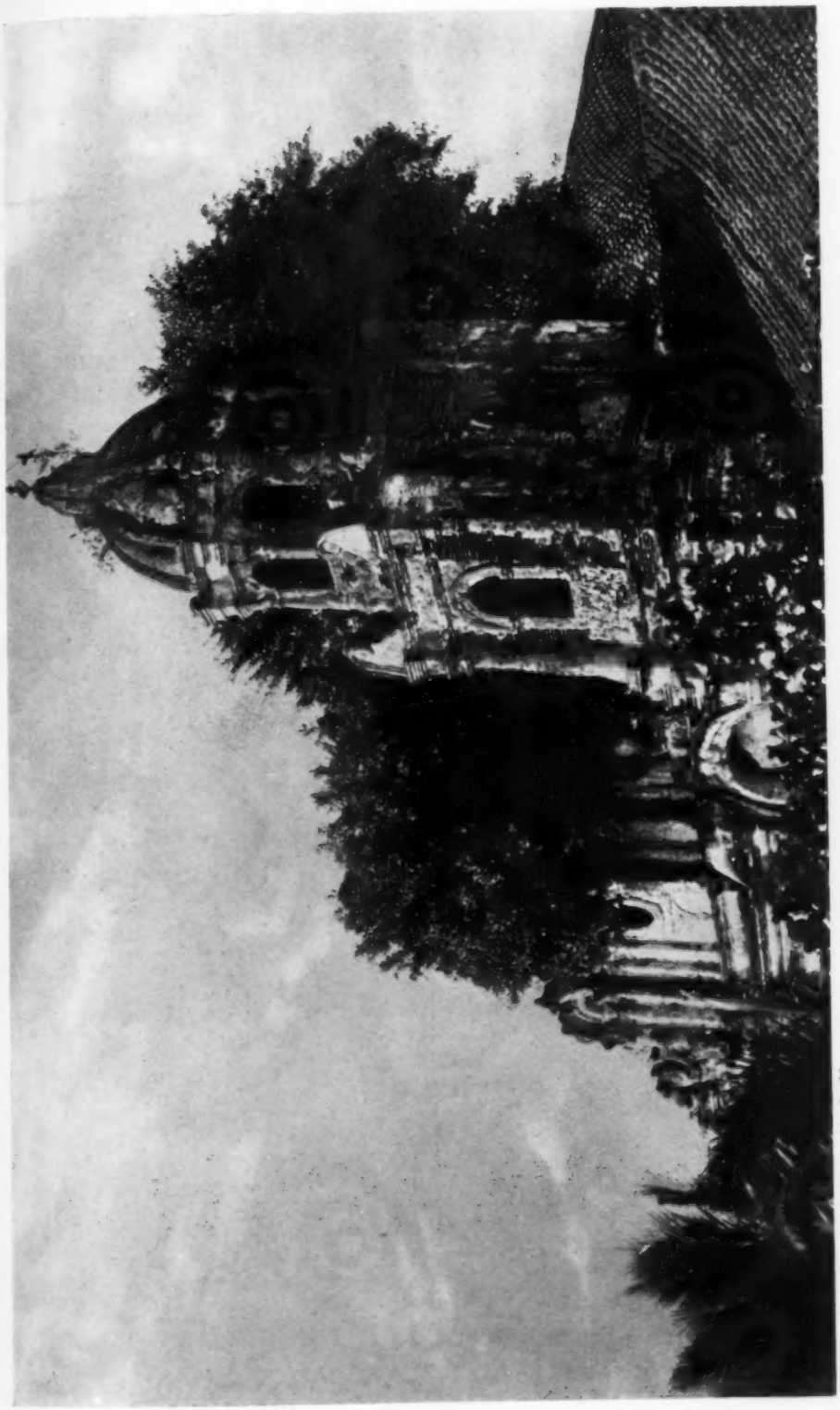
Red corpuscles of blood in a physiological salt solution were rapidly destroyed by the waves, although some indicated much greater resistance than others. Blood count in a live mouse indicated that the number of red corpuscles was reduced to 60 per cent of the normal value when the water in which the mouse was placed was "rayed," although as the authors point out, this is not conclusively a result of the "raying," since mere fright alone is known to reduce the blood count. However, the mouse became thoroughly dejected by this treatment, and was quite weak after twenty minutes of it, although he later completely regained his health and spirits. On the other hand, fish and frogs succumbed after two or three minutes exposure to the high-frequency waves.

It is not in order to ask now what may be the use of these observations in physical, chemical, and biological application; but one should bear in mind that it is just such laboratory experiments as these on which are to be built the practical developments of the future.

Purely scientific discovery is very much like an infant, introduced to the world without acclaim or display, without knowledge of what degree of eminence he may reach in the future, but demanding no small share of admiration from his parents with their cherished hope—if nothing more—that before many years have passed he will play an important rôle in the affairs of the world.

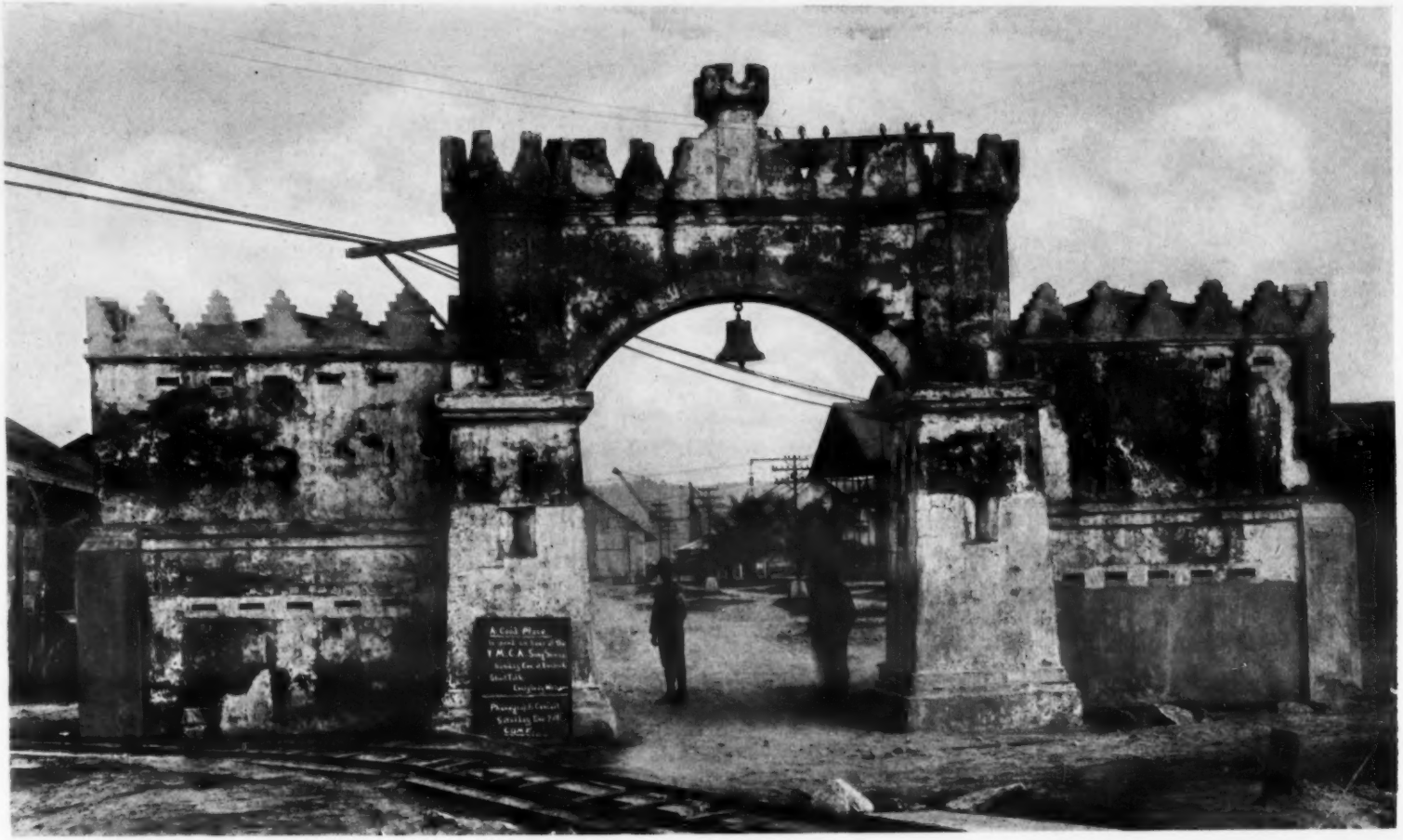
Whatever may have been the thrill experienced by Jacques and Pierre Curie when first they put pressure on a tourmaline crystal and observed as a result a slight deflection of their electrometer needle, even the most inspired imagination would scarcely have induced them to suppose that this discovery of a pressure-electric effect would eventually lead to crystalline slabs expanding and contracting at a rate of several million times a second; to compressional waves in the sea carrying sufficient energy to stun and kill fish; to a means of deep-sea sounding; or to an aid in stabilizing communication between a flying craft and the earth. Yet Future, ever bringing up the rear of Past and Present, has now, fifty years later, unfolded these realities to us; while at the same time we are awaiting the embellishment of present knowledge by future application.

[12] Wood and Loomis, *Philosophical Magazine*, 4, 417 (1927).



Courtesy Lieutenant H. F. Cope, U. S. Navy

TOWER OF SANTO DOMINGO CHURCH, CAVITE, BUILT IN 1602
This church was used as a place of worship by the garrison of Fort San Felipe.



Courtesy Lieutenant H. F. Cope, U. S. Navy

WEST GATE OF NAVAL STATION, OLONGAPO

WEST GATE OF NAVAL STATION, OLONGAPO

Courtesy Lieutenant H. F. Cope, U. S. Navy

SOUTH GATE OF NAVAL STATION, OLONGAPO
Note the many shell holes in the wall.

Courtesy Lieutenant H. F. Cope, U. S. Navy

PORTA VAGA DEFENSES

This is the front view (looking toward San Roque) of the building shown on the opposite page.

This is the front view (looking toward San Roque) of the building shown on the opposite page.

Courtesy Lieutenant H. F. Cope, U. S. Navy

PORTA VAGA DEFENSES

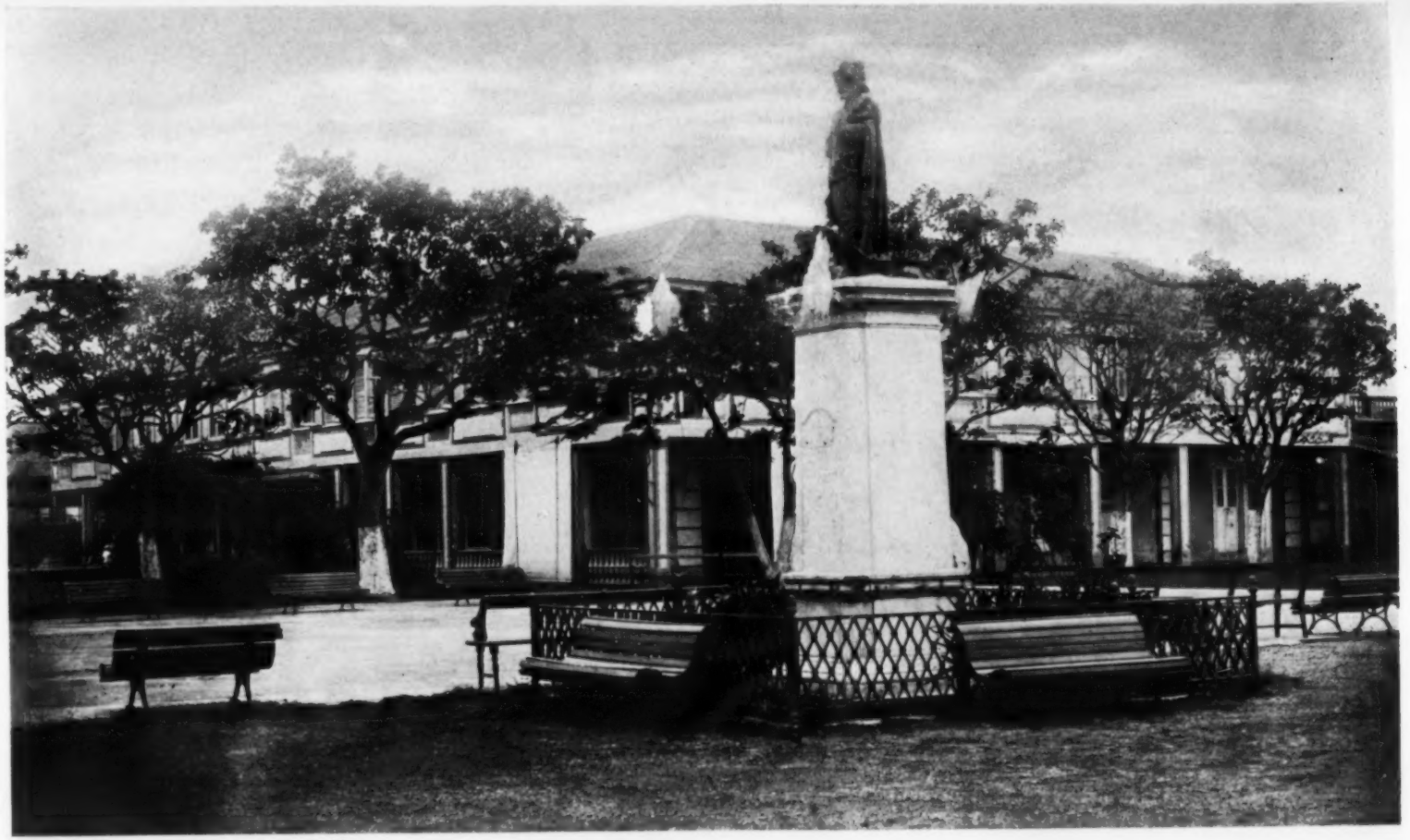
This rear view (looking toward Cavite) is now building No. 107 of Cavite Navy Yard and was erected in 1602.

Courtesy Lieutenant H. F. Cope, U. S. Navy

THE COMANDANCIA AS IT IS TODAY

Courtesy Lieutenant H. F. Cope, U. S. Navy

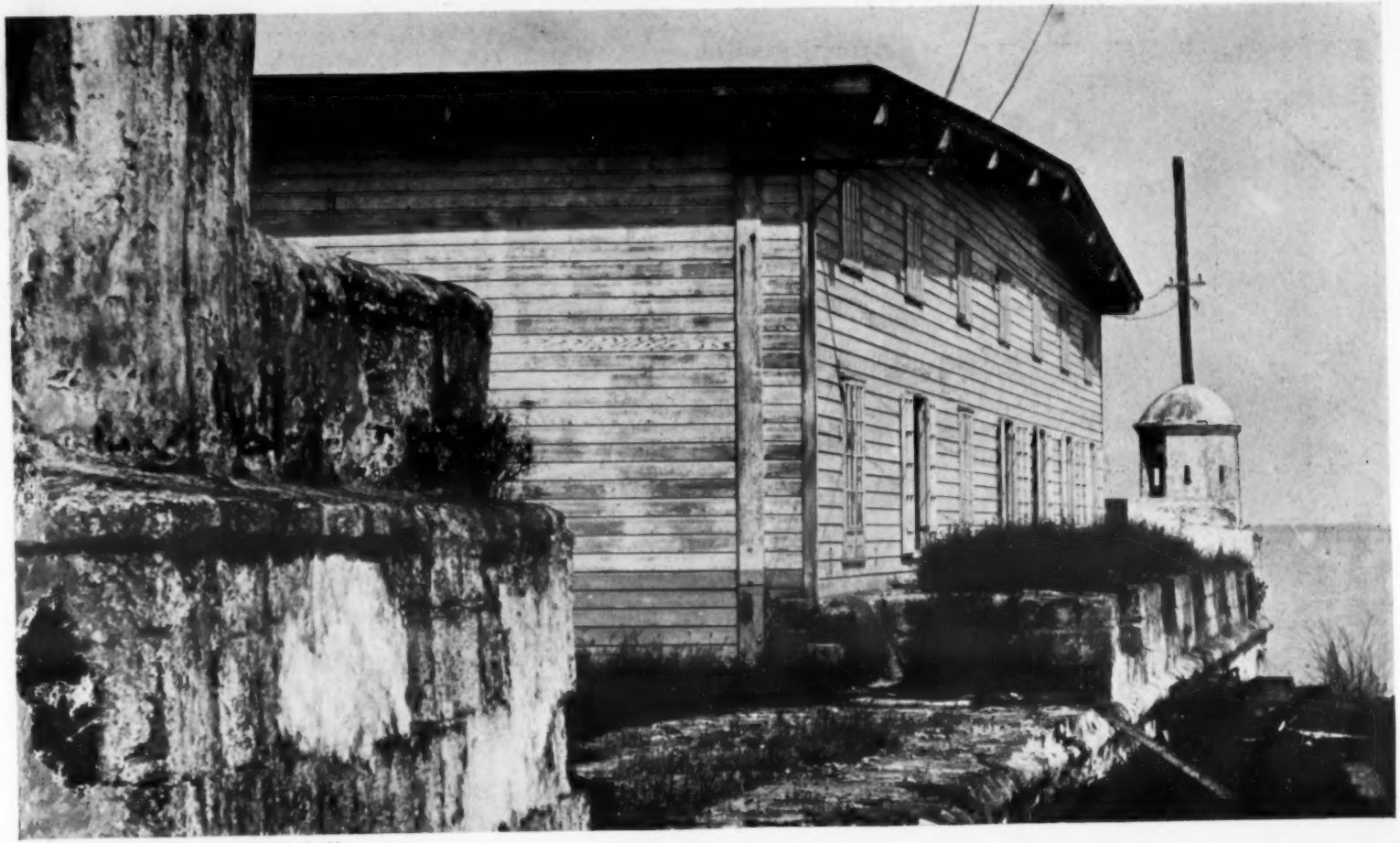
THE COMANDANCIA AS IT IS TODAY



Courtesy Lieutenant H. F. Cope, U. S. Navy

STATUE OF JUAN SEBASTIAN DEL CANO WITH THE COMANDANCIA IN THE BACKGROUND
This noted Spanish explorer, who was with Magellan, was really the first to circumnavigate the globe.

UNIV. OF MICH.



Courtesy Lieutenant H. F. Cope, U. S. Navy

FORT GUADALUPE

This section of the old fort, built in 1602, covered the approaches from Bacon Bay.

Historic Cavite Navy Yard

By LIEUTENANT HARLEY F. COPE, *U. S. Navy*

THE average naval officer regards the navy yard at Cavite as merely a place to which he is required to go every year to have his ship overhauled; and he longs to get clear of the yard as quickly as possible after being there a week.

During the overhaul of my submarine this year I found an opportunity to delve into the history of the various points about the yard, as it impressed me as rather odd that the government should construct buildings that seemed so out of place with modern architecture. I then discovered that the majority of the buildings, especially the permanent ones, are just the same as they were when built by the Spaniards as far back as 1603.

To get historical information about the forts and other defenses one has to rely mostly on hearsay stories. No records were kept of the construction and builders of the various edifices of interest. The priests in Cavite and Manila were very nice and gave me any information that had been passed down to them. In fact, when they learned that I was able to talk Spanish, they went out of their way to help in my quest for information; but in many cases they were helpless due to the failure of their predecessors to hand down written information.

Referring to the line sketch of San Felipe which was made from charts, I would like to call attention to the manner in which the Spaniards laid out their defenses. First, they built Fort San Felipe with massive walls, in many places twelve feet thick on the waterside from which would come possible attacks. On that side, i.e., towards Manila Bay, they had gun ports for twenty-six large guns and the walls were so angled that every sector was thoroughly covered from where Sangley Point now is, around to where the sector would be covered by the guns of Fort Guadalupe. These battlements were covered by horizontal roofs of such great thickness as to be almost impenetrable to bursting bombs of later days, and it is to be remembered that these walls were built in 1603 and are today in a fine state of preservation.

The section of Fort San Felipe facing the water front was used temporarily as a magazine soon after our occupation until a more modern storage place could be built that would incorporate all the safety features of our modern magazines. Afterwards it was used as a storage compartment and, after three hundred years, the government has found that practically no upkeep is required to retain the walls and roofs in a fine state of preservation. The Spaniards, when building the fort, without doubt had the idea of permanency in mind; and it would certainly be a point of pride if some of the original Spanish engineers could now view their work after these many years.

The house perched high up on the top of the main gate of Fort San Felipe was formerly inhabited by the commanding officer of the fort. It is now the residence of the captain of the yard of Cavite. Near the main gate of the fort and in the wall itself, the thickness of which extends as much as fifty feet, the Spaniards had a fresh-water reservoir which our engineers tell us has a capacity of 99,000 gallons. Thus the fort could withstand not only the heaviest shells of the times but also a water famine.

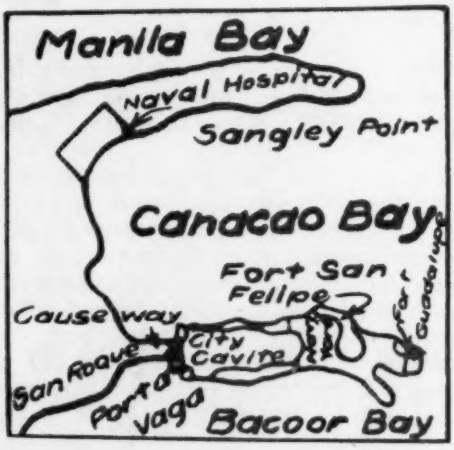
On the southern corner of the fort still stands the original gate to the old Spanish navy yard with its adjoining guard house. The walls to the south of the gate originally extended to the water's edge and sea wall.

A large moat, shown in the sketch, served as a first defense barrier against attacking forces and evidences of it are still to be seen in front of the section landward from the water battlements.

To the old Santo Domingo church, now a mass of ruins but still a monument of old Spanish architecture, the inmates of the gar-

FORT GUADALUPE
This section of the old fort, built in 1602, covered the approaches from Bacon Bay.
Courtesy Lieutenant H. F. Cope, U. S. Navy

rison of San Felipe could go and worship. Money and labor were not spent on it as on the walls of the fort and, consequently, it has not stood the ravages of time as well, and is slowly crumbling away. A few more years should see it erased from the sky line of old Cavite.



On the north side of the interior of the fort now stands the Navy commissary store, the storerooms being the original buildings in which the Spaniards used to retain their stores against the times when they were unable to go out and forage.

On the eastern side and corner of the fort we find that the section used as an arsenal by the former occupants is now used as a prison for Navy general courts-martial prisoners. When it came to the matter of constructing buildings in which there was neither unwanted ingress nor egress the Spaniards were without equals.

On the eastern corner is the old flagpole on which Admiral Dewey hoisted our colors for the first time. A bronze tablet on the wall gives the historical data of the event that was to mean so much in our later history.

The history of the present house of the commandant of the Sixteenth Naval District is an interesting one. It seems that during the reign of Charles IV, in Spain there lived in his court a page who won the love of the queen, later the queen dowager, and became her lover. In order to place this growing power as far as possible from him, the king banished the page to Spain's most distant possession, the Philippines. However, the queen possessed enough power to see that the young man was given the title of Marquis of Bartholomew, and from her own pocket-book she sent him a generous allowance of money each month. On the arrival of the prison galleon in Cavite, the young page was confined within the walls of the arsenal of Fort San Felipe, but not for long. The young marquis, who was soon popularly known as Valenzuela, had a most charming and magnetic personality. Before many days passed he had been released from his prison and allowed to live as he pleased, as long as he remained close to the fort. Supplied with plenty of money from his queen, he caused to be erected the present comandancia where he held a regular royal court and entertained on a lavish scale.

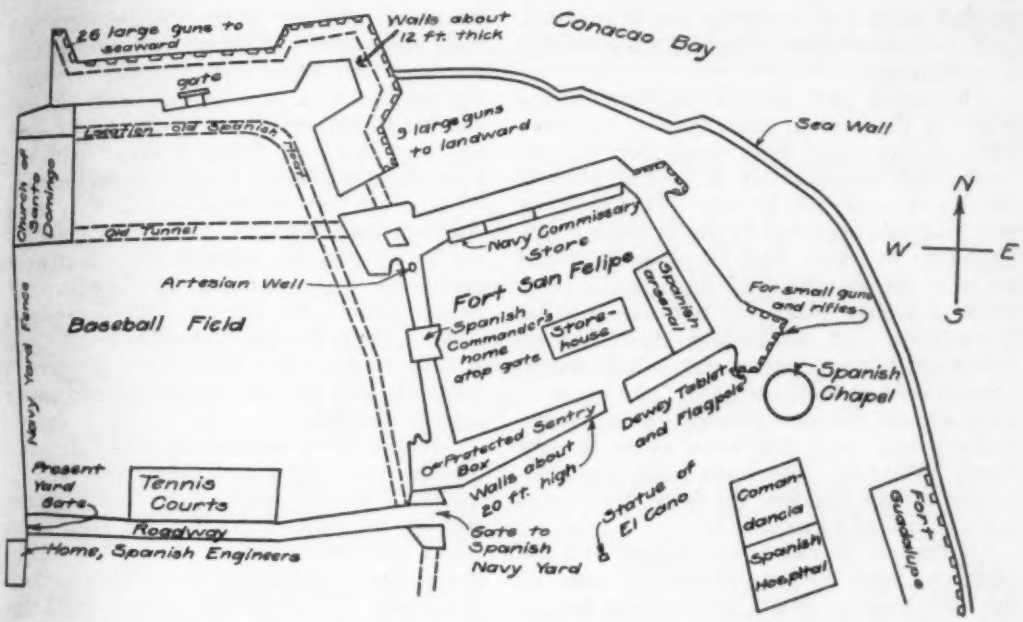
As was usual with all Spaniards of rank and wealth, he built his own little chapel. It is located across from the comandancia and is used now as an employment office for civilian laborers. On the floor of this building there is a large marble slab covering the remains of a number of Spanish heroes who gave their lives for their country in the year 1872.

Back of the comandancia and attached to it there was built a large hospital. Evidences of many articles of use in a hospital still remain. This hospital building is now used by the industrial department, the entire structure being the original one with the exception of a few modern improvements.

Between the home of the commandant and the assistant commandant is the statue of Juan Sebastian del Cano, the Spanish second Magellan, who, the inscription tells us, with only nineteen men in his crew, traveled many unknown seas. He followed easily in the footsteps of the famous Magellan who, although a Portuguese by birth, became a naturalized Spaniard. Magellan perished in a small fight or skirmish on the island of Mactan in the southern Philippines, on April 25, 1521. Del Cano was the first circumnavigator of the world.

Fort Guadalupe was located southeast of Fort San Felipe and was used to fight off the smaller boats that attempted to land on Cavite from Bacoor Bay.

The original defense of Cavite in the days of its construction could easily be considered impregnable. Cavite is an island, and as such was fortified by the Spaniards



to defend it against large warships from Manila Bay and pirates from the other side.

The Porta Vaga defenses had perfect control over the causeway connecting Cavite to the mainland. It is believed that the original wall from the waterside of Fort San Felipe extended along the water front to the Porta Vaga defenses. It is only natural to suppose that this is true, for, if the Spaniards lacked sufficient money, they did have plenty of cheap labor and building material. The large granite-like blocks, called dhobie stone, used in the construction of these huge walls, were quarried about forty miles from Cavite.

Two sets of underground passages are reputed to have connected Fort San Felipe to Porta Vaga. As I have talked to some of the men who assisted in the digging about the yard in the additional constructions, I am inclined to believe that the report is true, for the diggers found many slabs of the sort that were used in the construction of old tunnels.

The old sea wall which surrounds Cavite is of its original construction of dhobie stone and, with the exception of a few minor repairs, is still instact.

In Bacoor Bay, to the south of Cavite yard, are the remains of as many as six Spanish ships, some of them being of the armored type. It is interesting to note that alongside the dock where my submarine secured during its overhaul was the old Spanish cruiser *Patino*, a steel fighter of older days, sunk in 1880 and still resting there under a few fathoms of water. A short distance outboard of this are the remains of several other ships that sought their last resting place about this time.

It is also interesting to know that the Battle of Manila Bay could very truly be called the Battle of Sangley Point, for the Spanish ships were lined up between Sangley Point and the present radio station and Dewey brought his ships over from Manila Bay to engage them.

One of the men to whom I talked, now a civilian workman in the navy yard, was on Dewey's flagship, the *Olympia*, during the engagement. A condensation of his story of the battle is humorous from a sailor's point of view.

> On the morning that we fought the battle we got over pretty early, soon after sunrise, to give the Spaniards a few salvos. We made a few turns and fired many shells at the enemy. Then the Commodore knew his men were hungry so he took us back to Manila Bay where we lay behind the supply ships until we had had our morning chow.

Dewey had not given out the information to all hands that the reason for the temporary retirement was to take stock of the remaining shells. Some of the ships had ex-

pended quite a few during the first attack and on some of them there was a possibilty of a shortage.

The lower part of the building to the south of the present main gate of the navy yard is now used as a ship's service and restaurant, while above it is the enlisted men's clubroom and library. This building was built and occupied by the Spanish Army engineers in 1880. The Filipinos used part of it as an arsenal, and that part is now used as a safe place for our movie films. Even after the occupation the Filipinos continued to keep possession of this threat immediately outside the gates. As we were then trying to use pacification measures nothing was done for some years to oust them. After the Americans finally took possession of the building the navy yard limits were extended to include it.

Of course, no old Spanish story is complete without its accompanying one of buried treasure. Many are the tales told of vast treasures that were carried from place to place and hidden in the underground passages to escape the searching eyes of the successful marauders. Numerous are the excavations that have been made in the grounds between Fort San Felipe and Porta Vaga to uncover the golden doubloons that are supposed to be hidden there. I have yet to find any authentic report of a discovery of any note.

From what I could learn it would seem most likely that the Porta Vaga defenses were built first, for it was here that the old Chinese pirates used to land when they sailed down from Amoy intent on plunder. Buccaneers from the Dutch Indies also came up to enrich themselves at the expense of the wealthy Spaniards. Fort San Felipe in its original form, i.e., without its battlements to the water's edge, seemed to be the next construction, for it is a complete fortress within itself, depending in no way on the water fortifications for support. As the pirates became more bold they brought up larger ships and, instead of attacking from the rear through the causeway in front of Porta Vaga, boldly attacked the fortress of San Felipe.

In the seventeenth century Sangley Point did not exist; it is only within the last hundred years that the sand has filled in, gradually forming the present point known as Sangley. The bay in its original form was fully covered by the many large guns from the water battlements of San Felipe. During the Battle of Manila Bay it is only reasonable to suppose that the Spaniards lined up their ships off Sangley Point, with the idea of getting heavy support from the guns of the fort but for some reason they were not brought into use. After the cannonading by Dewey, the Spanish ships that were able to do so got under way and endeavored to get behind the lee of Fort Guadalupe. Two of them, however, could not move, one a short while before having had her boilers taken out and the other not being ready after a yard overhaul.

I cannot resist mentioning one of the gates to the navy yard at Olongapo. That it has stood several sieges and attacks one can see by the telltale bullet and shell holes which are plainly visible. The defenses of Subig Bay were not as formidable as those of Cavite. When the marauders found that they could not make a success of their attacks on the latter, they centered their fury on Olongapo and left many evidences of their spirited and furious attacks; but the Spaniards always seemed to hang on tenaciously to their possessions. Here as in all other places the Spanish built forts and defenses that they fully expected to occupy for many years, and it was mainly through their thoroughness in construction that they succeeded so well.

These few historic spots that I have pointed out in the navy yard at Cavite are now in such a wonderful state of preservation that it is believed many generations of naval officers will be able to see them before they finally succumb to the ravages of time.

Despite the fact that the ancient arrangement of things in general is a handicap to the yard force, modern work is done here throughout the year on a number of ships. One often marvels, on leaving the yard after being entirely refitted and overhauled, that the regard for preserving intact the historical buildings and walls has caused many extra footsteps in going from one department of work to another; and one has a great desire to congratulate those responsible for the ingenuity of arranging the departments so well around the frowning walls of Fort San Felipe.

Admiral Sir Percy Scott *and* Gunnery *of the* British Navy

By H. A. De Weerd, *Department of History, Denison University*

The very first thing I did when I returned to the Admiralty as First Sea Lord for those seven months in the first year of the war was instantly to get back Sir Percy Scott into the fighting arena. I had but one answer to his detractors and to the opposition to his return: "He hits the target!"—Admiral Lord John Fisher

General De Peucker's famous remark about an army—"The more an army lacks in war experience, the more it needs to make use of the study of the history of war for its instruction"—is equally applicable to a navy. An acquaintance with the recent history of the British Navy is necessary to the proper understanding of Anglo-American naval relations. Without minimizing the services of a group of men such as Freemantle, Wilson, Jackson, Oliver, and Jellicoe, it can safely be said that the development of the British Navy in recent times has closely followed the careers of two men, Lord John Fisher and Sir Percy Scott. Admiral Lord John Fisher built up a powerful fleet which checkmated Germany's naval aspirations. Admiral Sir Percy Scott saw to it, in spite of the inertia of the Admiralty, that the fleet could fight on equal terms with the enemy. He made the British Navy hit the target.

In 1865, when he was eleven years old, Percy Scott entered the British Navy and passed a period of training on the old ship *Britannia*. As a final part of the training of the young sailors, they were taken on a cruise around the world. In the day of the sailing ship this cruise was an important and often a very extended affair. It opened the eyes of Scott and others to conditions in the fleet. His first lesson in gunnery took place off the coast of Arabia when his ship captured an Arabian slave dhow. The commander of Scott's frigate decided to hold quarterly target practice and to sink the craft by gunfire. The slave dhow was anchored; Scott's ship moved off, fired a quarter's supply of ammunition without effect, and finally had to sink the craft by ramming. Such was the gunnery of the British Navy.

After Trafalgar the British Navy enjoyed a half century of inactivity. The fighting school of admirals was replaced by a social school. The appearance of a ship came to be considered more important than her fighting power, and endless time and energy was spent in painting ships and holy-stoning decks. Officers, eager to have their ships present an attractive appearance, often spent part of their salary in addition to the money provided by the Admiralty for paint. A typical annual inspection report for the year 1901, in which every emphasis is placed on the appearance of the ship and in which no mention is made of the guns or state of gunnery efficiency, follows:

H.M.S. *Glory*, Hei-Hai-Wei
3d, September, 1901

I have made the following remarks in the report of the inspection of H.M.S. *Astraea* under your command:

The ship's company of good physique, remarkably clean and well-dressed; state of bedding especially satisfactory.

The stoker division formed a fine body of clean and well-dressed men. At exercise the men moved very smartly.

The ship looks very well inside and out, and is very clean throughout. Her state is creditable to the Executive Officer, Sir Douglas Browning.

The tone of the ship generally seems to me to be distinctly good. The appearance of the engine-rooms and their appendages was very good.

Signed ( ) Admiral.

Were it not for the mention of the stoker division and the engine-rooms, this report

might well pass for one made in the Elizabethan Navy.

Early in his career Scott saw the essential fact that a battleship is merely a floating gun platform propelled by sail or steam. To his mind every emphasis should be placed on the vital part of the ship—the guns and their equipment. He naïvely supposed that the Lords of the Admiralty were genuinely as eager to improve the service as he was. With youthful enthusiasm he submitted a number of patents and devices for their approval. They wrote the young officer letters thanking him for his proposals, but invariably found some reason why his suggestions could not be adopted. Scott invented a light and serviceable fire helmet, but the Admiralty decided to retain the old and utterly useless one. He devised an excellent flash lamp on the principle of the Venetian shutter for signaling between ships at night. Many years later the Admiralty adopted it. He helped construct a target which did not collapse when hit as the Admiralty pattern did; but the Admiralty took four years to accept it. He brought out a "deflection teacher" to aid gunnery students in correcting their aim, a "dotter" for practice firing, and an efficient sub-caliber gun which would have saved the Admiralty £40,000 a year on ammunition alone, but it delayed seven years before accepting it.

It was exceedingly difficult for a man in the service to get his proposals accepted by the Admiralty. There were many reasons for this. The civilian element in the Admiralty was more permanent than the naval element, and the naval element often found itself outweighed. Avoiding responsibility was an all-too-common practice. Young officers were more fearful of doing something wrong than they were eager to improve the service, and the older officers favored proposals which came from the men at the desks in Whitehall. An officer or enlisted man in the British Navy could patent a device, provided he first submitted it to the Admiralty by letter which would be circulated to the various departmental heads for their approval or criticism. Sometimes these letters would be greatly delayed in passing through the Admiralty; often they were never reported on at all. So consistently were the proposals from men in the service boycotted by the Admiralty that one officer, who had invented a device which increased the effectiveness of the Whitehead torpedo and wanted his government to profit by his invention, sold it to the Whitehead factory, for he knew it would be declined if he submitted it to the Admiralty. As it was, the Admiralty accepted it at once, when submitted by the Whitehead factory. On March 15, 1899, the Admiralty took a definite step to discourage the native genius of Percy Scott for invention. They wrote him that in their opinion "the holding of a number of patents would constitute a grave objection to his being selected for any scientific or administrative post in H.M. service."

Scott's difficulties with the Admiralty were lightened by a period of active service in Egypt, South Africa, and China. He arrived in Egypt in 1882 just too late to witness the bombardment of Alexandria but he saw the effects of it, and noted that the town had suffered more from the wild shooting of the fleet than had the guns of the forts. Out of three thousand rounds fired, mainly from anchored positions, Scott could only count ten direct hits on the guns of the forts.

An opportunity soon came for Scott to distinguish himself. Sir Archibald Allison wanted three heavy guns moved from Fort Pharos to Ramleh so that he could bombard Arabi Pasha's position at long range. Scott volunteered to move the 7-inch guns and did so with surprising speed and ease. This exploit gave the young officer a reputation for facility in handling heavy weights and for the solution of practical engineering problems in the field. This faculty was put to use in 1900 when Scott righted H.M.S. *Canton River* which had capsized in a storm at Hong Kong.

During the South African War Scott was commander of H.M.S. *Terrible* and acted as military governor of the port of Durban. At the outbreak of the war the British Army had no artillery which could cope with the heavy Creusot guns of the Boers. Sir George White at Ladysmith asked the Navy for a gun mounted for service on land, which could outrange the Boer artillery. In a few hours Scott had mounted a 4.7-inch gun and had given it an exhaustive trial. This gun with a supply of ammunition was forwarded from Durban to Ladysmith and performed valuable service in

keeping down the fire of the Boers. Sir Redvers Buller saw how useful this gun had been and asked for additional naval guns which were speedily mounted. At a time when the Army was not provided with long-range weapons, these guns came as a god-send and their value was recognized in the official dispatches of Sir Redvers Buller. Scott also assisted in maintaining communication with Ladysmith by improvising a searchlight flasher on the Venetian shutter principle.

Percy Scott rendered his greatest service to the British Navy in the field of naval gunnery, which differs materially from artillery practice on land. The battery commander on land can aim and fire his pieces by means of the clinometer with almost mathematical accuracy, even when the target is invisible. The gunnery officer on ship board cannot use the clinometer because his gun platform, the ship, is not steady or exactly level. These considerations and others have led to the dictum that only fools attack forts with ships.

Effective naval fire can only be made at long range by firing the guns of the ship in parallel and correcting the range by noting the fall of shot. If the guns of the ship are properly calibrated and can be aligned in parallel, it is a relatively simple matter to gage the correction necessary and to begin hitting the target. But as guns increased in destructive power, they were encased in steel turrets. This made firing in parallel difficult. As the range increased the gunners in the turrets could no longer see the target at which they fired. It became necessary to station an observation officer on the masthead to report to the gunnery officers below the range information. The observation officer was, so to speak, the eyes of the gunners. The means provided by the Admiralty for conveying range information from the masthead to the turret-rooms was a voice pipe. But the roar of the guns, the clash of metal rammers, and the noise incident to handling heavy charges drowned out the voice of the observation officer. This system, although obviously unsatisfactory, was retained by the Admiralty for many years.

In February, 1905, Sir Percy Scott was appointed inspector general of target practice, a post somewhat similar to that once held by Admiral W. S. Sims, U. S. Navy. On a visit to Kiel in that year Scott noticed that the Germans were allowing their guns an elevation of 30 degrees while the British only allowed 13.5 degrees. Greater elevation means greater range. A 12-inch rifle with an elevation of 15 degrees will throw a shell 16,000 yards; the same rifle will throw the same shell 24,000 yards if given an elevation of 30 degrees. Scott at once urged the Admiralty to increase the elevation of the guns in the British Navy, but it did not respond until 1909, and then increased the elevation to 15 degrees. It was not until 1915 that the Admiralty increased the elevation on the new ships to 30 degrees although the Germans had been enjoying greater range in gunnery for ten years.

Before Scott undertook his great reforms, the gunnery of the British Navy was very bad indeed. In 1897, the year that England began to encase naval guns in turrets, the percentage of hits to the number of rounds fired was only thirty. By insisting upon a thorough calibration of all guns, new sighting gear, and frequent target practice, Scott was able to raise the percentage of hits to eighty by 1907.

Sir Percy Scott had long interested himself in the problem of transmitting range information from the masthead to the turret-room by some means more satisfactory than the old voice pipe. In 1881 he had constructed a rudimentary form of his later director system. He arranged a dial in the observation station upon which the range corrections were made and were instantly recorded on a similar dial in the turret-room by means of electricity, and no amount of noise or bustle interfered with the rapid transmission of range information. Scott, while at sea, submitted this proposal to the Admiralty which rejected it. On his return to England he found that the invention had been pirated, and it was not until thirty years later that the Admiralty decided to adopt Scott's director system.

John Fisher's creation of the *Dreadnought* in 1905 made material changes necessary in the sighting of the guns of this powerful ship—an all-big-gun ship and a decided improvement over the older type of battleship with a mixed armament. Yet the *Dreadnought* with all her strength had several weaknesses. When under way in heavy weather, the spray from the bows obscured

the vision of the gunners in the forward turrets, and the 6-inch batteries, lower in the ship, were often flooded. In addition to this, under the same conditions, the smoke from the forward guns and funnels blinded the gunners in the after part of the ship. It became imperative to adopt some means whereby the guns could be sighted and fired by someone on the masthead where vision was unimpaired. If this could be done and the guns fired in parallel, the full efficiency of the *Dreadnought* would be realized.

Percy Scott improved upon his early form of the director system of firing and gave it careful trials in actual service. By installing it on H.M.S. *Terrible,* Scott was able to make her stand first in gunnery. He employed it in H.M.S. *Scylla* and raised her to first place in gunnery competition. While second in command in the Channel Fleet, Scott installed the director system in H.M.S. *Good Hope* and she in turn became top ship in gunnery. Successful as these trials were they failed to convince the Admiralty. When Scott left the *Good Hope* in 1913, his successor ripped out the director system and went back to the Admiralty's method. Scott had repeatedly warned the Admiralty that the Germans had adopted a good modification of the director system. On December 11, 1911, he wrote:

> The Germans I am informed have for some time used a very good modification of the director system, which allows them to fight the guns of their ships in parallel. As we cannot do this efficiently, it gives the Germans such a superiority in gunfire, that if a British fleet engaged a German fleet of similar vessels, the British fleet would be badly beaten in moderate weather, but annihilated if it was rough.

Less than three years after Scott wrote this letter, Admiral Cradock in command of H.M.S. *Good Hope* and *Monmouth* met the German admiral, Count von Spee, off Coronel with the cruisers *Scharnhorst* and *Gneisenau.* The *Good Hope* carried two 9.2-inch guns and sixteen 6-inch guns and the *Monmouth,* fourteen 6-inch guns. The lesser British ships *Otranto* and *Glasgow* carried smaller armament, but made no determined stand. The *Scharnhorst* and *Gneisenau* each carried eight 8.2-inch guns and six 5.9-inch guns. On paper the British ships were the equal of the Germans, and the *Good Hope* had been late top ship in gunnery. But the weather was bad and just what Scott predicted in his letter of December, 1911, happened. Scott's director system had been ripped out of the *Good Hope,* and the British ships, blinded and unable to parallel their guns, were quickly sunk by the German ships which suffered no appreciable damage.

In 1912 Sir John Jellicoe and Winston Churchill insisted that the Scott system of director firing be given a fair trial. Two ships were detailed for gunnery tests. One ship, the *Orion,* used the Admiralty system of firing its guns, and the other, H.M.S. *Thunderer,* was equipped with the Scott director. The test occurred in Bantry Bay on November 13, 1912. The range was 9,000 yards, and the targets were towed at the same speed as the ships were steaming, twelve knots. The ships fired as fast as they could for three minutes and then ceased firing. The test was decisive! An examination of the targets showed that H.M.S. *Thunderer* had scored six times as many hits as H.M.S. *Orion.* As a result of this test Winston Churchill ordered the Scott director installed in twenty-nine ships of the *Dreadnought* class.

Installation proceeded slowly, but by the time of the Battle of Jutland, May 31, 1916, the director system had been installed in nearly all the ships of the Grand Fleet in the main armament, and its value was dramatically demonstrated in this long-range action. Had the fleet been fighting its guns in the old manner, greater losses and even defeat might have resulted. Admiral Jellicoe wrote after the encounter:

> The conditions under which that action (Jutland) was fought converted any waverers at once to a firm belief in the director system, and there never was afterwards expressed any doubt as to its great value.
>
> (Jellicoe's *Grand Fleet,* p. 67)

On June 4, 1914, Scott, who had been a lifelong student of the submarine and torpedo, published a letter in the London *Times* in which he pointed out the fact that Germany was building numbers of seagoing submarines, and that in event of war with Germany the mutual threat of submarine attack would automatically cause the capital ships on both sides to go into hiding. He declared that the submarine and the airplane had revolutionized naval warfare. At once the safe and sane admirals issued a flood of replies to Scott's letter. "Scott was an alarmist." "The idea that a submarine can

scare capital ships into hiding was mischievous nonsense." Two months later the war came. As Scott predicted the mighty ships in the Grand Fleet stole away by night to distant Scapa Flow, there to remain between nervous periods at sea in mortal terror of submarine attack until good merchantmen had been sunk to provide booms and harbor protection.

Scott had retired in 1913, but Winston Churchill and Lord John Fisher brought him out of retirement into the fighting arena in 1914. He was commissioned to construct a fleet of dummy battleships, and made such convincing dummies that there is at least one widely circulated account of a German submarine torpedoing a dummy for a British capital ship. As in the case of the South African War, Scott once more came to the assistance of the Army by mounting long-range naval guns for service in France. He also acted as chief of the air defenses of London and brought order out of chaos in that unhappy situation. When H.M.S. *Queen Elizabeth* was ready to send to the Mediterranean to take part in the Dardanelles enterprise, Scott declares that Winston Churchill offered him the command. But he knew the fleet in the Mediterranean, and above all he knew the limitations of naval gunnery and flatly refused to go. He looked upon the Dardanelles failure as one of the blackest pages in the history of the empire. After he was freed from the control of the air defenses of London, Scott was advisor to the Admiralty on matters of naval gunnery. Fisher left the Admiralty in 1915, and the following year Scott too ended his service with the Navy after fifty years of active duty.

How Peace?

When a strong man armed keepeth his palace, his goods are in peace.—LUKE xi: 21.

By LIEUTENANT COMMANDER T. L. GATCH, *U. S. Navy*

RUSKIN said that if each shot fired in war broke a teacup in a housewife's cupboard there would be no more war. One wonders if, after all, this most vexing problem of war and peace might not be best attacked from this simple angle.

Whether or not one agrees that universal peace is as desirable as those who talk say it is, still anyone must feel sick at heart that so much human thought and endeavor could be devoted to any problem with so little result. And whatever may be the philosophic view, the practical American view must now be for peace; for no American can fail to realize that for the United States at this present time peace is to be devoutly desired. Let us all pull together.

At the outset we must ask the perfervid pacifist to dismiss all hope of the United States contributing anything to the peace of the world through example by disarming; for the United States is the one nation that has the most to lose and the least to gain through war, and consequently her example would be taken as mere self-serving, actuated very largely by her alleged material-mindedness, and discounted accordingly. "Unquestionably there is no more peaceful power than America. Pacifistic phrases have always proved themselves highly effective with the American mob, but what empire ever dreamed of making anything but peace reign on earth, provided that that peace was its own?" (L. Dumont-Wilson in the *Revue Bleue* of Paris.) As the most dangerous navigator is the man that has become cocksure, so the most dangerous enemy to peace is the man who is *sure* the way to peace is by disarming, or he who is *sure* it is by having enough armament to thrash all the rest of the world. There is a happy mean.

We must take another premise: the consummation of universal peace will be neared to the same degree that unanimity is reached amongst all men that such peace is for the good of the world; and the good of the world, in any man's eyes, is the good of that man, not the good of some other man. When tea cups must surely be broken—more broken than can be pillaged—in every home in every warring nation, unanimous dislike for war will likely follow.

Extolling peace, decrying war, is no new thing. It would be well for our present-day apostles of peace to disabuse their minds of the thought that they are the first honestly to preach peace; for otherwise they are apt to fall into the error of believing that mere preaching and treaty making may bring peace about. There has lately been a good deal of preaching about treaty making, yet we see the world today almost in a panic of war. War's horrors are fresh in mind; its cost bears hard. Soon there will be a generation of fighting age to whom these horrors are but the tales of old men, and eventually the price of the last war will have been paid. When that time comes will the world, as it has always done in the past, take to war again? To prevent this with certainty something more is needed than preaching, or organizing debating societies, or emitting pamphlets, or signing treaties—something tangible, concrete, patent.

The beauties of peace have been recognized for centuries, yet peace eludes us. No less than 2,400 years ago there lived a man who might be called the world's only successful pacifist—that is, the only one that ever had his ideas adopted to a measurable degree. His name was Lao Tse, and from his teachings came the Taoist religion; not the only religion to inculcate pacifism, but the only one whose converts have actually lived pacifism. China is notably the one

great pacifistic country. Look at it! Moreover, China tried, in the sixth century before Christ, our present concept of a league to keep peace. And it worked for a hundred years—something its successors have yet to approach. One doubts that the Western world can ever provide such promising soil for the maturing of these two ideas as China did. If they did not succeed in the East what chance have they in the West? Then again, China has none of the newly discovered, much belittled, so-called narrowing, insular, patriotism that has come to be so derided by our internationally minded pacifists. It is said that the word "nation" does not occur in the Chinese language. China is the one truly peaceable country in the world today; and the only one where war seems to have become perennial. War, there, is leader against leader; is this the corollary to want of nationalism?

The Greeks tried a league to maintain the peace. There have been leagues innumerable, to preserve peace so long as the league had its way, down to the League of Nations. Even the Holy Alliance was formed by the contracting sovereigns with the "fixed resolution to take for their sole guide the precepts of that Holy Religion (Christianity)." Could one find better precepts for a league of peace? Buddha preached peace; Christ taught peace; their followers have been as warlike as the followers of Mahomet. Herodotus quotes Croesus as saying to Cyrus: "For no one is so senseless as to choose of his own will war rather than peace, since in peace the sons bury their fathers, but in war the fathers bury their sons." Erasmus wrote in 1509:

> If there be anything in the world that should be taken in hand with fear and doubting, yea, that ought by all manner of means to be fled, to be withstood with prayer and to be clean avoided, verily it is war; than which nothing is more wicked, or more wretched, or that more farther destroyeth, or that never hand cleaveth sorer to, or doth more hurt, or is more horrible, and briefly to speak, nothing doth worse become a man (I will not say a Christian man) than war.

Verily the honest prayer for peace is no new thing.

So very recently as 1462 Georg von Podiebrad, King of Bohemia, proposed a federation of the Christian nations, with an international parliament, and a court with an international army to enforce its decrees. At the beginning of the seventeenth century Henry of Navarre, the greatest king of his day, observing that good Christians were getting set for a struggle between Roman Catholics and Protestants, advanced a suggestion for a league of European nations to preserve the peace. This came to be known as the "grand design" and started a veritable plethora of schemes. In 1693 William Penn wrote a very sound and earnest book entitled *The Present and Future Peace of Europe*, containing many good suggestions. Twenty-three years later the Abbé St. Pierre proposed a permanent congress of European states, arbitration, and disarmament. This was apparently the first definite suggestion for disarmament. Jeremy Bentham, in 1789, and Immanuel Kant, in 1795, presented peace plans more meritorious than most later ones. Thomas Paine, who perhaps did more than any other one man to embattle the Colonists, spent his later years writing impassionedly for peace. In 1815 the first peace society in the world was organized in New York; and within a dozen years there were fifty such societies in the United States alone. In 1843 the first great international meeting of peace societies was held in London. Then came the signal success of arbitration in the Alabama claims settlement, and at last a light seemed to be dawning. This was followed by the Hague conferences and the Hague court. The world seemed to be shaping a safe course until the World War came to show how far out it was in its reckoning. Finally, a reversion to the old idea of a league. From all this it will be seen that the gamut had been completed with the proposal of the Abbé St. Pierre in 1716; nothing new has been offered in more than two hundred years.

Why have nations fought? Formerly when government was a one-man or one-family affair the simple wish for personal glory and renown was all that was needed to start a war; for the nation as a whole was not much involved, the fighting being done by professional soldiers, a draft rarely being necessary. Thus we see Alexander conquering the world with a handful of Macedonian fighting men, the peasant and the artisan remaining undisturbed at home; Cæsar conquering Gaul with his legionaries, seizing the government with the same men, the citizens of Rome gaping at his

triumphs or reveling in his games, otherwise undisturbed. So it continued through the days of feudalism, almost down to the nineteenth century. War was not a matter of nation against nation nearly so much as it was of leader against leader. Witness Wallenstein in the Forty Years War raising an army of 40,000 troops solely on the prestige of his own name—40,000 fighting for Wallenstein and themselves much more than for the empire. In the days when wars were fought for personal glory they were fought by soldiers who also sought personal glory and personal gain, not by men thinking of their firesides.

As has been said: "A people's war in civilized Europe is a phenomenon of the nineteenth century." This was a fundamental change in the nature of war that could come only as the result of a social upheaval, in this instance the French Revolution. The wars that followed were the first in history where nations *qua* nations were arrayed. There grew a national consciousness that had been theretofore unknown. The national consciousness thus so comparatively recently engendered has taken the place to some degree of the older glory of the person that had been a prolific cause or war; but always with this restriction, that the personal appeal was the stronger, and the leader with a great reputation had little trouble finding enough men of like mind with himself to make up the small professional army he needed. Your democratic soldier wants to go home; though his enlistment expire in the very face of the enemy, he is off. Nevertheless this love of country has been played upon to the point where it has been a potential cause of war, particularly in the less democratic countries. Harping on "a place in the sun," praising one's own country, disparaging one's neighbors, fomenting a sense of wrong—all have been used with success to work a people up to the war pitch. But now this appeal loses its force; in these more sophisticated days a subtler method must be followed.

National glory will readily make a people fight to retain what they already have, for if they lose anything, they lose caste amongst the nations; but any man would be loath to run the chance of being killed at five miles for the sake of gaining an island in the antipodes, especially when in the back of his mind might be the thought that all the good of the island could be got in a more clever way. Today one is fairly safe in predicting that the campaign against war has succeeded to the extent that a war between great civilized nations primarily for the mere purpose of national glory is impossible. National glory may now be more safely enhanced by a ribbon salesman than by a fighting man. Napoleon, the greatest master of war there has been, foresaw this: "War is an anachronism. Some day victories will be won without cannon and without bayonets."

Glory, personal or national, has been a cause of wars; undoubtedly in some cases, as that of Alexander the Great, the chief cause. But practically always there has been an underlying cause, and when the adulation, hero worship, egotism, and such like things have been cleared away this cause stands out as the strongest of all—gain. Look about today—wherever there is war or threat of war, the cause is loot. This is the appeal to the man in the street. Look at all the wars fought within the memory of men now living, and very easily under the camouflage may be found the real, honest, ugly reason. The United States has contended, with relapses, for the freedom of the seas; meaning that private property at sea shall be immune from capture. Great Britain has opposed. Now the United States is self-supporting; Great Britain could be brought to starvation within a fortnight. Why the paradox? Would not one think that Great Britain would jump at the chance, above all things, of an immune food supply? Was the German admiral (Vice Admiral Meurer) right when he wrote recently:

> Since the seventh century—that is, since she has held dominion over the seas—England has made use of her naval power more consistently for political purposes than any other nation, true to the Viking spirit of booty which lies so deep in the blood of the Britons. The war years were often harvest years for England and this harvest consisted of the private possessions of enemy and neutral citizens.

In the preface of a book written over eighty years ago (*Napoleon and His Marshals*, J. T. Headley) we find:

> Men of peace are straining every nerve to destroy the love of glory in our youth, while every war among civilized nations, probably for the next century, will be waged to secure the privileges of

commerce. *Cupidity*, not love of glory or personal ambition, is to be the source of future collisions.

Our present-day apostles of peace have made a discovery—a bright, new, startling, discovery; neither to victor nor vanquished does war pay. This brilliant induction is based on one case, the World War, and of course an induction of such meager data, except by the sheerest accident, is not true. The world has had untold centuries of cheap war; it has had but little over one century of costly war. During this last century, for the first time in the history of civilization, there has been more peace than war. And during this time there would probably have been no wars at all between the more progressive nations but for the fact that it was seen that certain wars could pay. For example the three wars Prussia fought within a decade paid easily a thousand fold. These were the last war recollections of Germany up to the World War. Dangerous! The two wars Japan fought within a decade raised her from comparative poverty to wealth. The foreign trade of the United States doubled after the Spanish-American War. To aver on the strength of one war and in the face of at least half a dozen to the contrary that have occurred in our own day that war never pays the victor is to betray the soft-headedness that is responsible for the stagnation the universal-peace movement has reached. The reiteration *ad nauseam* of an untrue formula gets us nowhere—it does harm. Under some conditions war does pay the victor. If we can find what those conditions are and remove them we can get somewhere.

Glancing briefly at the wars that have fretted the world from the American Civil War to the present we note that there were in this period two great wars and a number of lesser wars. The great wars, the Civil War and the World War, cost in a material way many times any possible material gain that could be figured from them; but on the other hand some of the shorter wars, as has been pointed out, did pay and pay immensely. The more we think of these wars the more manifest it becomes that the shorter a war is the more it may pay. Also, this is but common sense; think of the many millions of dollars a day war costs.

Another thing strikes us: at the start of both of the great wars it was well-nigh universally believed that they too were going to be short. Even Grant wrote his father on May 6, 1861: "My own opinion is that this war will be but of short duration." Lincoln's first call for volunteers was for three months. One lone voice cried out in the night: General Winfield Scott pronounced that the South might be conquered "in two or three years, by a young and able general . . . . with 300,000 disciplined men kept up to that number." Nobody paid the least heed to the old croaker; he was a pessimistic soldier; the man in the street knew that the war would be over soon.

The South owned over a billion dollars worth of slaves; in a material way it would pay to fight to that extent, although as everyone knows the material aspect had nothing to do with the great majority of the men of the South. Had there been secession instead of the compromise in 1850 there probably would have been no war. By 1861, however, it was clear that secession meant war. That put the South in the situation of repelling invasion, added Virginia to the Confederacy, made the great majority spring to arms. The South was far from agreement as to secession; in fact in some states secession was engineered by a decided minority. Had the majority there foreseen that the war would last four years, and take forty years to recover from, how far would the secessionist minority have got?

We all remember the outbreak of the World War. Most people were stupefied as it dragged on and on. It was unbelievable. Lest after knowledge dim the thoughts of those days, allow me a personal anecdote. At the outbreak of the war I was one of a wardroom mess of some thirty officers. The mess discussion got around to predictions of the duration of the war. I remember the occasion well because I timidly ventured the term of five years and was chagrined that the nearest any other officer came to me was one year, and most thought it would be over before the end of that present year. Those were men that knew considerable of war and of the history of war. Their views were borne out by practically all of the continental writers up to 1914. These writers did not doubt that there would be a next war (only the English and the Americans doubted that) but

they were convinced that it would last a matter of months at the most. A favorite reason for this conviction was that no nation could long bear the terrible expense of modern war. Actually such reasoning reached a vicious circle; what it amounted to was that war had to be short to pay, therefore it would be short. The belief that it could be kept short was one of the egregious errors that made the World War possible.

No original idea looking to universal peace has been advanced in two hundred years. During this time there has apparently been progress in the adoption of peace ideas; but no single idea has come to the fore, nor grown to the point where it has been recognized that it will work in practically every case; there has been vacillation from plan to plan; plans have been tried in combination; still no panacea has been found. The sad part is that there is a certain inherent danger in peace plans, which may grow, like a malignant tumor, to destroy the very life of which it is a part, a danger well expressed by Alexander Hamilton in a letter written in 1777:

> We are told here there is to be a Congress of the neutral powers at The Hague for meditating on peace. God send it may be true. We want it; but if the idea goes abroad, ten to one if we do not fancy the thing done, and fall into a profound sleep till the cannon of the enemy waken us next campaign. This is our national character.

The latest peace essay, the Kellogg treaty, is an old idea broadened. It is much the same as the pious covenant of the Holy Alliance, but, being broadened to include the world, it is safe from the infamous use to which the latter was finally degraded. The Kellogg treaty has been signed in entire good faith, and yet not a practical man in the world dares believe it to be more than a devout wish. One of its staunchest advocates in the United States Senate on the very morrow of the outlawry of war starts work to codify the laws of maritime warfare. The outlaw is still to have laws that it must observe. This would be nonsensical except for the fact that a practical statesman well conversant with world affairs must realize that the complete outlawry of war, no matter how solemnly effected, is not to be accomplished by dignified statesmen signing formal documents. War will be outlawed only when the man in the street wants it outlawed, and completely outlawed only when he wants it outlawed always under all circumstances.

How does the man in the street look at war? There is room for much cynicism here, but the truth probably is that his views depend entirely upon the war. The man in the street could list at least a dozen possible wars, of any one of which he could say: "That would be a terrible war." Why could he say that? Because he, with a general superficial knowledge only, can evaluate closely enough to know that the balance of power between the nations involved is such that one could overcome the other only through the most tremendous possible exertion. He could continue and say that such a war would be disastrous to both countries and a curse to civilization. On the other hand the man in the street could list a great number of wars to any one of which he could say: "Oh, there would be nothing to that." Furthermore he would be rather indifferent to the thought of it, even though his own country, provided it were the stronger, were involved. The professional soldiers and the volunteers could handle such a war; not he nor his son would be disturbed. Where the forces are even, where the power is balanced, he deprecates war very strongly; where they are uneven he is apathetic.

One hears exclamations: "The balance of power. Horrors! That is what brought on the World War . . . . obsolete . . . . weighed and found terribly wanting."

So by way of proving that we are reasoning animals we turn to something else that has also been tried and found wanting—but longer ago.

The balance of power was but one of the things that failed, if it did fail, in preventing the World War. In 1914 there was no league of nations, but there had been the peace conferences; there was no Kellogg treaty, but there was as solemn a treaty guaranteeing the neutrality of Belgium. Did the balance of power fail? The answer must be yes, for the war happened despite the balance of Triple Alliance with Triple Entente. Why did it fail? Because the balance had not been struck clearly enough to come home to the man in a street of Berlin. Had that man thought for an instant that the war would last four years there would have been no war. That man thought

that his opponents were too wise to fight till the bitter end. He thought one step further than a leading French statesman, who said on July 31, 1914:

> This I know for certain, that the Germans will not declare war against us. They are no idiots. They reason, and they are not crazy. I tell you that they will not go to war.

Perhaps the man in Berlin could not have returned the Frenchman's compliments. This man also thought one step further than a leading English statesman, who said in January, 1914, that then was "the most favorable moment for twenty years" for cutting down expenditure on armaments, and who said as late as July 23, 1914, that "next year there will be a substantial economy without interfering in the slightest degree with the efficiency of the Navy. . . . . The encouraging symptom which I observe is that the movement against it (expenditure on armaments) is a cosmopolitan one and an international one." The German knew that that movement had been cosmopolitan and international for almost a century. He doubtless thought that nations whose very leaders were so at sea would not prove to be formidable. Moreover, he thought up to the last minute that there was a good chance of England's not coming into the war at all, and he counted Italy on his side. In other words he did not see the balance. The balance of power failed to prevent the war because it was hidden and was thought to be contingent. Really the fault was England's for presuming that, after many centuries of proof, even the German would know that England's hand to a treaty meant just what the treaty said it meant. Walter H. Page wrote in a letter to Colonel House on September 8, 1915: "If the English had raised an army in 1912, and made a lot of big guns . . . . There would have been no war now. . . . ." Remember that the German thought the war would be short, that the only power that would really tell at all was power already organized, as there would be no time for any new organization to become effective before the end of the war. Napoleon said: "Battles ought not to be given unless one can reckon in one's favor seventy chances of success out of a hundred." Looking solely at organized forces, the German so reckoned. The balance of power failed to prevent this war not through any defect in the principle of the thing, but because of the supineness of those who should have kept the balance so clear to the man in a street of Berlin that all the war propaganda possible could not have made him believe that the war would be short and easy. Every man in Berlin knew the German Army would be in Paris by Christmas.

In matters of sociology art nearly always fails. The Constitution of the United States has proved least successful where it innovated; most successful, where it adapted historical developments. The balance of power has been an entirely natural growth; most other schemes for universal peace have been deliberate innovations, and, except as they have actually been based on a balance of power, have proved chimerical. Preparedness is but a way of maintaining a balance of power. "To be prepared for war is one of the most effectual means of preserving peace." When a swaddled pacifist traverses this one may be pardoned a doubt. A royal road to anything worth while has never yet been found; a royal road to peace is a dream.

Woodrow Wilson entered upon the office of President of the United States an avowed pacifist; he left it advocating with all his might the largest, by far, naval and military force the United States has ever kept up in time of peace. Calvin Coolidge entered upon that office believing in very limited armed forces; he left it saying: "All human experience seems to demonstrate that a country which makes reasonable preparation for defense is less likely to be subject to hostile attack and less likely to suffer a violation of its rights which may lead to war." These two men at the ends of their terms had a practical knowledge of the governance of this world such as is vouchsafed very few. This practical knowledge had overturned their former beliefs and had left them thoroughly converted to the doctrine of the balance of power.

Limitation of armaments, so long as it is kept within reasonable bounds, is in accord with the balance of power; for the limitation itself will be by way of a balance. The great danger is that limitation may be carried to the extreme that it cheapens or appears to cheapen war. A cheap war may pay; a war that may pay is not hated by the common man. Of all the prayers a man may make the one he should make the most

sincerely is that war may never again be made cheap. The thought of a fifty-thousand-dollar airplane sinking a fifty-million dollar ship is hailed with paeans of joy by the pacifist—another instance where he is just 180 degrees off his course. A further danger of limitation of armaments is that it may be carried to the extreme that the non-military elements of power of a nation assume such a disproportionate weight that the apparent military balance does not actually represent a balance. Thus if all men-of-war were scrapped tomorrow Great Britain would unquestionably be mistress of the sea and could assert her maritime dominion to the exclusion of all other nations; for she has by far the largest merchant marine, and with naval vessels removed these merchantmen would be the power of the sea. If the foregoing dangers are avoided, limitation of armaments by way of a balance of power is the path that should be followed.

Roosevelt said: "Our voice is now potent for peace, and is so potent because we are not afraid of war." As fear may make a rabbit rush into the jaws of a mastiff, so fear has many times made a nation rush into war. We must always hate war but never fear it.

In the South a few years after the Civil War it became a matter of remark that there was no bitterness of defeat except amongst the women and the clergymen. Moreover the fighting men of the South would have quit some time before they did, when they saw that their cause was inevitably lost, but the women would not let them. Today we find that the ardent disarmist is almost invariably a person who by reason of sex, age, vocation, or physical or mental defect, would not have to do the fighting if war should come; and yet this same person would force a war to go to the bitter end and would longest remember it. Why is this? Could it be because the man who would have to fight, who has more than an academic, sentimental interest, does not hanker to be one of the mob of a million patriots that would spring to arms over night to face the cold, remorseless, disciplined ranks of the enemy? Could it be because such a man, having to take the knocks of life, knows full well that knocks, actual or prospective, are the best possible things in this world to keep men peaceable and mellow?

Let us conclude with a house-that-Jack-built formula that certainly may be followed by the man in the street and may perhaps be followed even by the last of our exempt classes:

The surest way to prevent war is to make war expensive.

The surest way to make war expensive is to preclude short wars.

The surest way to preclude short wars is to make certain that belligerents will be evenly matched.

The surest way to make certain that belligerents will be evenly matched is by a balance of power.

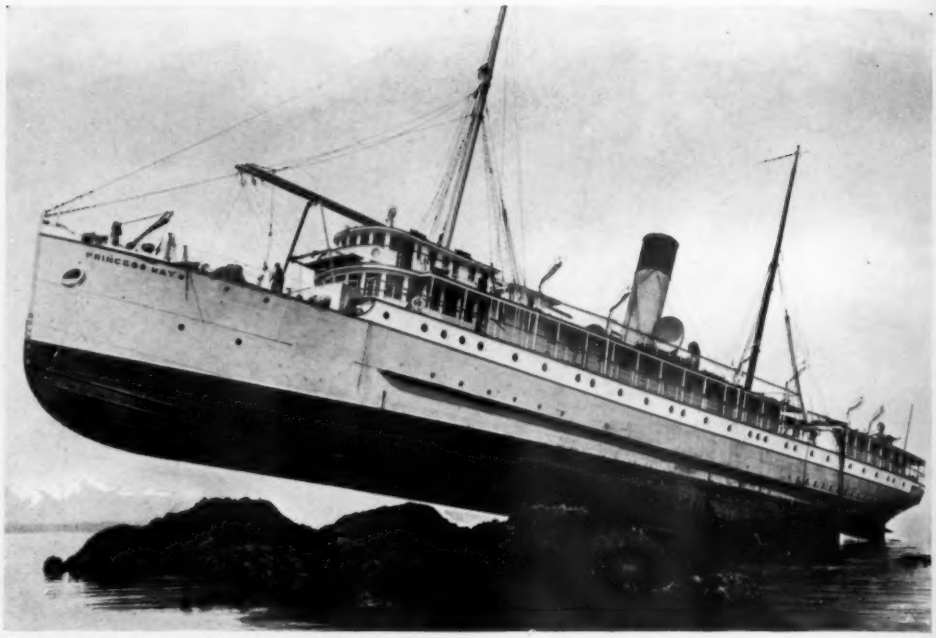
Courtesy Office of Naval Intelligence, Navy Department *From Lieutenant Thomas Macklin, U. S. Navy*

SS. *AL-KI* WRECKED ON POINT AUGUSTA, 1917

Courtesy Office of Naval Intelligence, Navy Department *From Lieutenant Thomas Macklin, U. S. Navy*

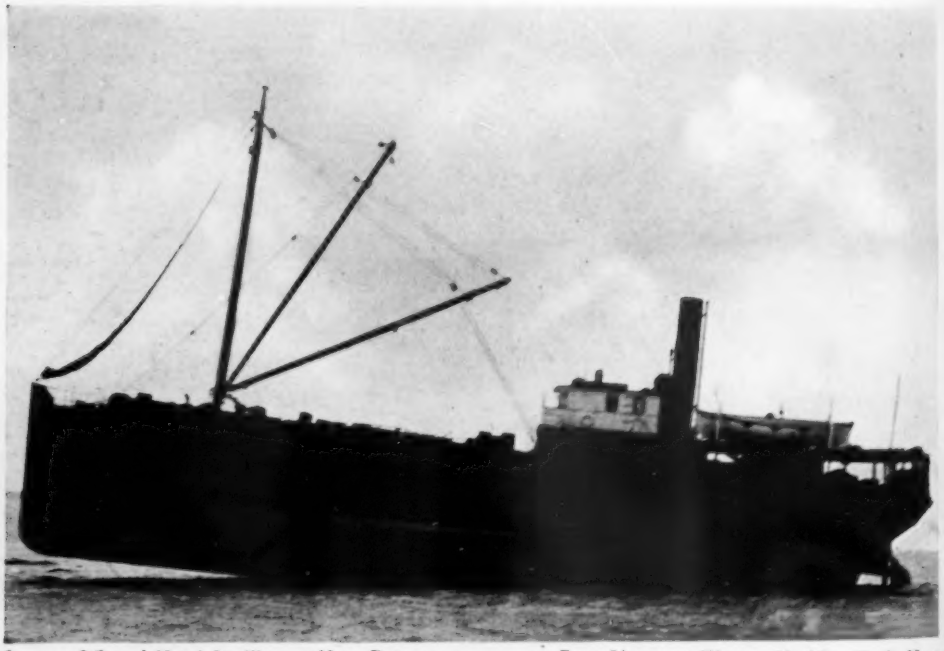
SS. *PRINCE ALBERT* WRECKED ON BUTTERWORTH ROCKS, AUGUST 18, 1914

UNIV. OF MICH.



Courtesy Office of Naval Intelligence, Navy Department *From Lieutenant Thomas Macklin, U. S. Navy*

SS. *PRINCESS MAY* WRECKED ON SENTINEL ISLAND, AUGUST 5, 1910

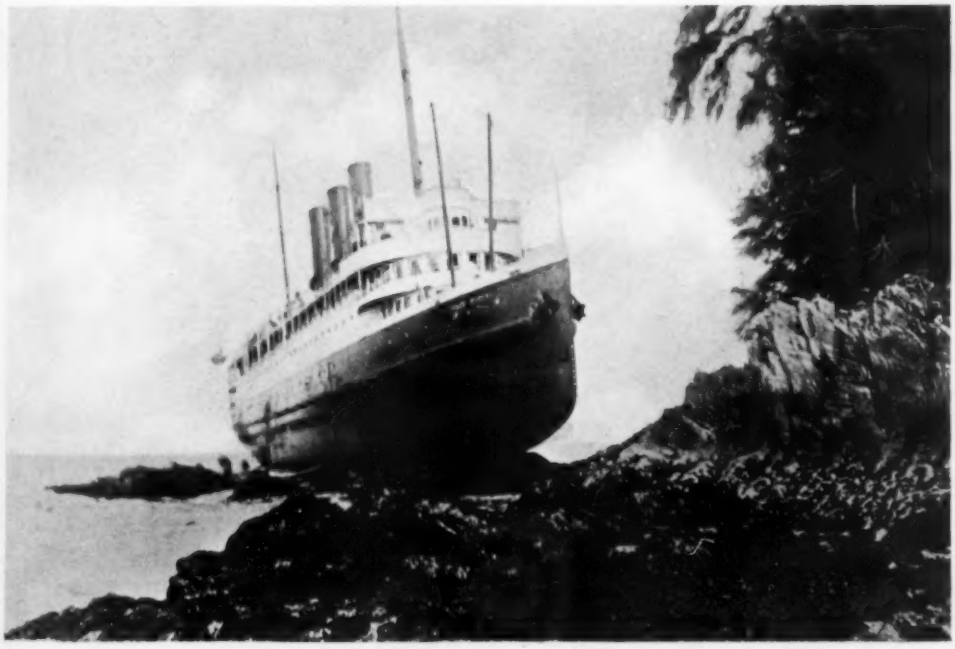


Courtesy Office of Naval Intelligence, Navy Department *From Lieutenant Thomas Macklin, U. S. Navy*

SS. *NORTHLAND* ON POND REEF, TEN MILES FROM KETCHIKAN, ALASKA

Courtesy Office of Naval Intelligence, Navy Department *From Lieutenant Thomas Macklin, U. S. Navy*

SS. *DELHI* WRECKED ON SUMMER ISLAND, ALASKA



Courtesy Office of Naval Intelligence, Navy Department *From Lieutenant Thomas Macklin, U. S. Navy*

SS. *PRINCE RUPERT* WRECKED MARCH 23, 1917

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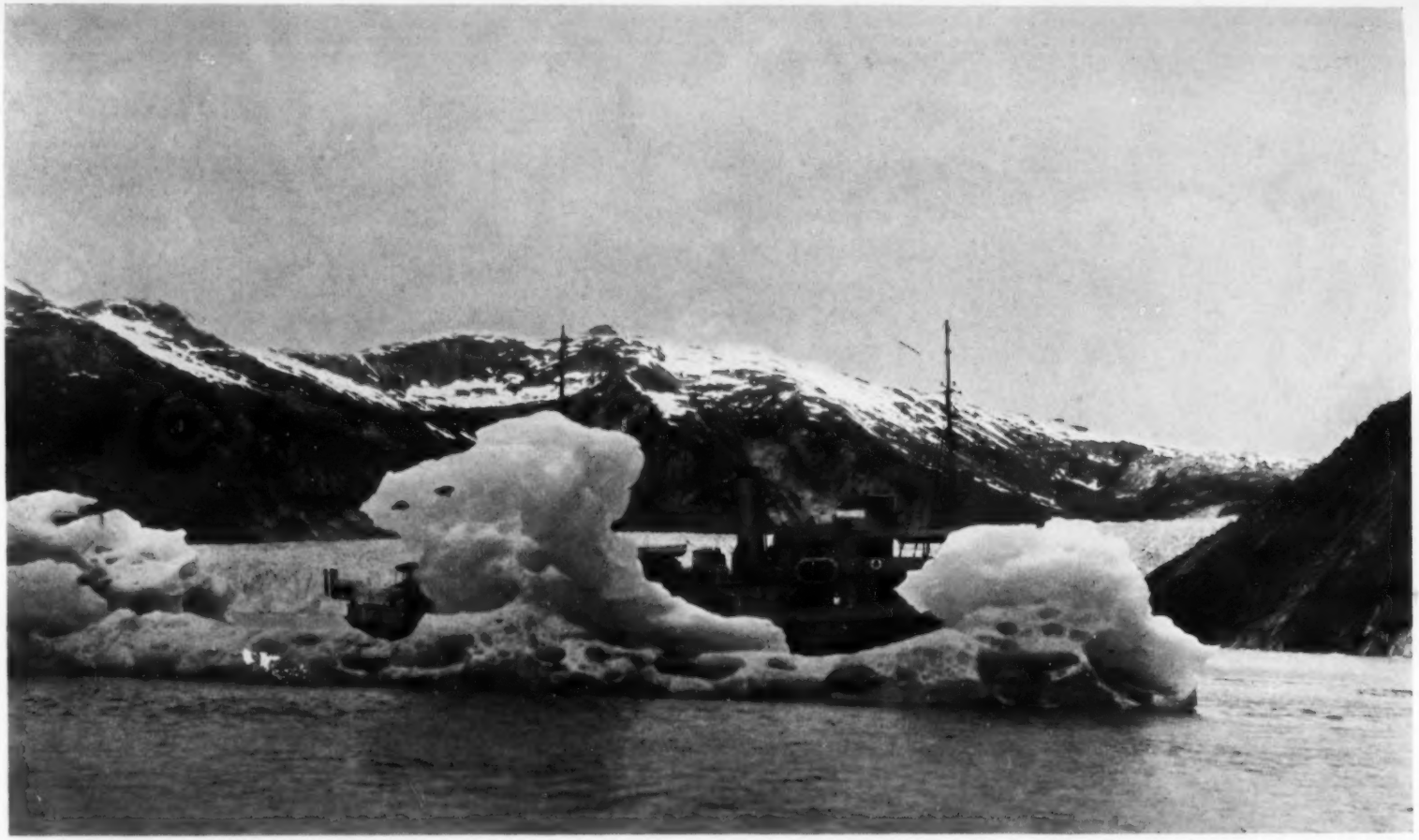
Courtesy Office of Naval Intelligence, Navy Department *From Lieutenant Thomas Macklin, U. S. Navy*

U.S.S. *GANNET* AND TOW LEAVING PETERSBURG, WRANGELL NARROWS, ALASKA

Courtesy Office of Naval Intelligence, Navy Department *From Lieutenant Thomas Macklin, U. S. Navy*

U.S.S. *GANNET* AND TOW LEAVING PETERSBURG, WRANGELL NARROWS, ALASKA



UNIV. OF MICH.

Courtesy Office of Naval Intelligence, Navy Department *From Lieutenant Thomas Macklin, U. S. Navy*

U.S.S. *GANNET* AT TAKU GLACIER, ALASKA, TEMPERATURE 74°

Courtesy Office of Naval Intelligence, Navy Department

From Lieutenant Thomas Macklin, U. S. Navy

U.S.S. *GANNET* AND HER TOW, Y. B. 88

UNIV. OF MICH.

Courtesy Office of Naval Intelligence, Navy Department *From Lieutenant Thomas Macklin, U. S. Navy*

KETCHIKAN, ALASKA, AND VICINITY

When entering, leave the island on either hand. The depth of water is eight to thirty-eight fathoms.

Courtesy Office of Naval Intelligence, Navy Department

GRENVILLE CHANNEL, BRITISH COLUMBIA

From Lieutenant Thomas Macklin, U. S. Navy

Navigating *the* Inland Waterways *to* Alaska

By LIEUTENANT THOMAS MACKLIN, *U. S. Navy*

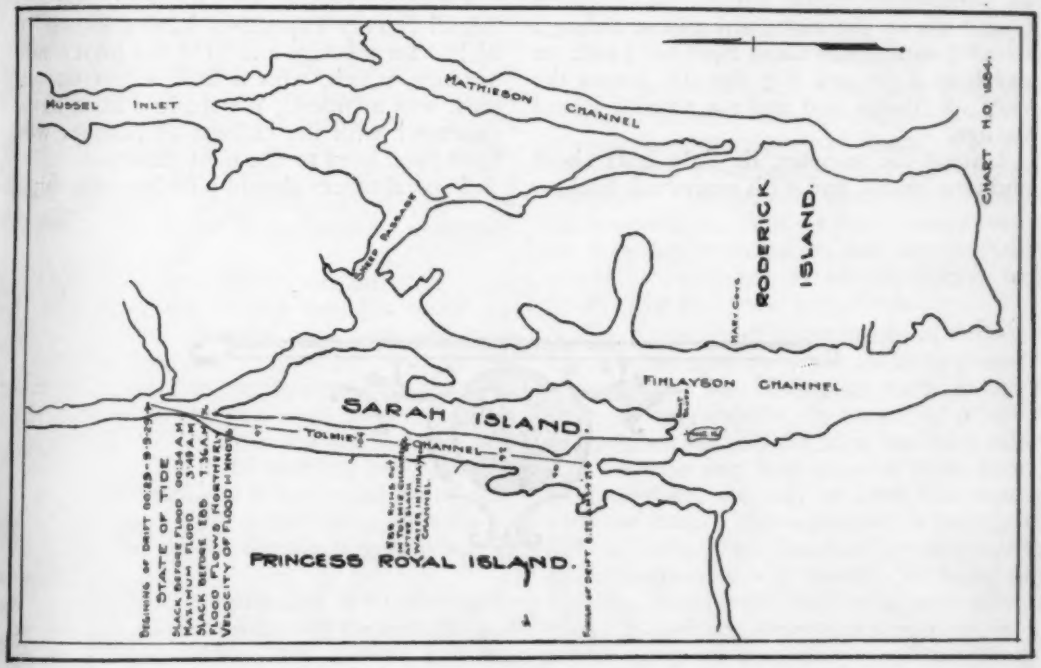
THE writer, in command of the aircraft tender *Gannet*, was attached to the Alaskan Aërial Survey Detachment. The expedition, under command of Lieutenant Commander A. W. Radford, U. S. Navy, was made during the summer of 1929, engaged in mapping southeastern Alaska.

The "lose your ship on uncharted reefs" legend persists to such an extent that it seems to be an axiom that naval vessels traveling these inland waterways of Alaska must employ Alaskan pilots. While all merchant vessels employed in the Alaskan trade carry two Alaskan pilots, one on duty all the time, pilotage is not compulsory.

The first 600 miles inland to Alaska are through British Columbian waters. While these waters are not so well lighted as those of Alaska, there are sufficient aids to enable the careful navigator to keep in the main channel. These waters have been traveled for years and have no uncharted rocks. The currents have been carefully checked and the results can be found in the tide and current tables, both British and United States.

These British Columbian waters have one stretch of water that should be traveled at slack water, that of Seymour Narrows; this is not only good practice but is required by our steamboat inspection service. The times of slack are given in the tide and current tables, and you are through in about five minutes. The *Gannet*, towing her barge, traversed these narrows without difficulty both northbound and southbound, from the description given in the sailing directions.

The *United States Coast Pilot* for Alaska gives the courses and distances from Four Mile Rock, Seattle, Washington, to Skagway via Ketchikan, Wrangell Narrows to Peters-



From Lieutenant Thomas Macklin, U. S. Navy

GRENVILLE CHANNEL, BRITISH COLUMBIA

burg and Juneau with alternate routes to avoid Wrangell Narrows from Ketchikan to Juneau. This takes you through Snow Pass and is eighty-five miles longer. It is used for night running and by long and deep-draft vessels.

Wrangell Narrows has been under improvement recently and has a controlling depth of twenty-one feet at mean low water and a range of tide of sixteen feet. It has a strength of current of four knots and it is customary to enter at either end two hours before high water; as the tides change in the center you will both carry the current and stem it on one flood tide. It has enough lighted aids, as one ship master remarked, to keep a vessel fenced in, and its navigation is more a question of putting the helm over than that of piloting.

Peril Strait is used from Juneau to Sitka. It has two bad stretches or passes; one, Sergius Narrows, about forty yards wide, must be entered at slack water, slack high preferred. Then comes White Stone Narrows, which can be carried southbound at any stage of tide. Long naval vessels bound north from Sitka to Juneau avoid White Stone Narrows because of the sharp turn, and come in through Salisbury Sound, which is twenty-two miles longer. All vessels bound out to the westward go out through Cross Sound, pass Cape Spencer (with an excellent light and fog signal), across the Gulf of Alaska and make a smooth inland voyage.

During the summer, daylight lasts about eighteen hours, and with numerous anchorages it is good practice to anchor at night. Fogs in the inland passages are to be expected and reliance must be placed on the echo of the whistle. The bottom is so deep as to make anchoring impossible and the lead of no value. Tidal arrows are shown on all the charts and are given in the tide tables. The practice is to keep the vessel straightened out in the channel, using the engines if drifting with the current, and noseing slowly ahead if stemming. The whistle should be given as short a blast as possible and the echo will show the closest bank, or if in the center the echo will be equal. The *Gannet* found one second indicated one hundred yards off the closest bank and three seconds three hundred yards off. Sketch shows the drift of the *Gannet* in a dense fog, how she avoided the north end of Sarah Island, and picked up Boat Bluff lighthouse as the fog began to lift.

In general, the inland passages to Alaska offer no problem to the naval navigator. There are no uncharted reefs or unknown currents on these inland waterways. The United States Alaskan waterways are well lighted and buoyed. The voyage is a coastwise one and the employment of coastwise pilots is forbidden by our naval regulations.

Pilotage is expensive, the 1926 Alaskan Aërial Survey expedition having expended $1,160 for pilotage and $116 for pilot's subsistence, which, with a little effort on our part, was avoided. We made a little naval character with the citizens of Alaska, who have been bred to the pilot theory.

A naval officer should pilot his own ship.

Organization *of the* U. S. Fleet

By COMMANDER E. G. ALLEN, *U. S. Navy*

DURING the last two or three years a movement has been on foot to return to the type force organization of the fleet that existed before the World War. At present we have a task force organization. Its merits are not often known even by individuals who presume to discuss its demerits.

The writer can think of nothing in the Navy he knew under the old type organization that recommends a return to it. Briefly it would consist of a commander in chief in immediate administrative command of six type forces—battleships, cruisers, destroyers, submarines, aircraft, mine layers, and sweepers. Each type force has an admiral who conducts administration and routine exercises and training for his type and, in theory, develops the tactics for his type. The last theory as to tactics collapses in parts, as the types are used in war in fleets, and only in fleet exercises can the rôle or organization of the type be determined. You need a fleet or force composed of types to develop fleet tactics. A type has no relation to itself, only as to organization, coördination, and employment with others—unless independently employed, as in night destroyer attack or in submarine reconnaissance or patrol.

The present task organization was adopted because certain men felt when war came in 1917 that the high command as a group had not been trained for the jobs that befell them, for our system had provided training only for one man and he arrived at the top at or near the retiring age. It is true that the 1916 building program had been authorized and this affected the organization adopted, for a battle-cruiser wing as a support force for the scouting fleet was in sight.

The present organization is an attempt to train four commanders and their staffs and to develop a theory, the tactics, and the methods for conducting the four functions of a combatant war fleet, and to create a commander in chief who would be in a position to devote his time to consideration of the strategical and tactical employment of fleets. If he arrives at this position after holding administrative command of another fleet, he should not feel he has been deprived, as it were, of his function, administrative command. If he feels he does not have direct command frequently enough, the Navy Department should devote more time to the concentration or let him take each fleet out at other times for tactical exercises.

Four factors only have lifted us out of the mediocrity that characterized our fleet development before the World War:

(1) What we saw and acquired abroad in the war.
(2) The present fleet organization.
(3) The annual concentration in its strategical and tactical phases.
(4) The force practices, gun and torpedo.

The present organization has one merit seldom realized: there is competition and a standard, as there are two fleets. The competing fleet commanders have an observing superior. Our gunnery competition is based on competition. We see the gunnery results as they are measurable, and are published annually as standards of excellence, with letters to meritorious personnel.

The competition in operation of fleets exists. It has had the same effect as gunnery competition; but, having no method of expression as publicity, its beneficial effect is not so obvious, and the view has been taken that because one fleet showed more poorly here or there the way to cure this was to combine them. This argument is fallacious. Where there is no standard by competitive effort mediocrity will result. To bring one fleet up, you should send your best officers to it. Longitude determines nothing as to merit, although operating conditions may. The Scouting Fleet has the more difficult

schedule, the poorer operating ground, and the worst material; it should have the best of the details and then would always stand up.

If any reorganization is made, the function of training the high command group should have first consideration. The Control Force as conceived had an important training function. The department little by little acted, and has left it nothing of its original function as to types, material, and operation but its name.

Type force organization achieved nothing in this Navy of extraordinary merit. I judge by what our standard was compared to the British and Germans in 1914-19. We are already overdone on type operation. Our deficiency is, has been, and perhaps always will be, a list capable of the exercise of the high command in war and a fleet system to support them. It is not attainable or furthered by type force organization.

The writer has no suggestions for reorganization to offer; he is merely reciting why the present organization exists and what it has done. If it is maintained, the support force of the Scouting Fleet might be the best two battleship divisions, and the Scouting Fleet could be designated west and the Battle Fleet, east. We should continue to have training and competition in the exercise of high command, and if necessary should lengthen the concentration and shorten the competitive exercises—in brief, worry less about our capacity to shoot or steam. We should not acquiesce in any curtailment of the training at tasks which fall to high command even though we may not assume that present training methods will insure the leaders required in war.

One thing is certain—one fleet of type force organizations and one fleet commander will not produce the leadership required. We should know this, because we should not forget experience. No radical change in human nature has occurred since we had type force organization. One sees the same men, but better methods.

Fighters

By LIEUTENANT COMMANDER FORREST SHERMAN, *U. S. Navy*

THE single-seater fighting plane has, on account of its speed, high rate of climb and power of maneuver, been commonly accepted as the most efficient fighting weapon which has yet been developed for use in aërial combat. However, the recent substitution of two-seater fighters as the equipment of one of the existing fighting squadrons of the Battle Fleet to replace its former equipment of single-seaters has served to focus service attention on the question of fighting plane types.

Prior to the delivery to the fleet in June of this year of sufficient Curtiss two-seater fighters for a complete squadron, fleet fighting and light-bombing squadrons had been equipped alike with single-seater fighters so designed as to be capable of use as light bombers, but there had existed in the service for some years a trend of thought toward the two-seater fighter idea which is now to be given its first real trial in fleet work.

It is fundamental that however fine a two-seater fighter may be produced by the advance of the aëronautic art, the same plane can, by modification of the design to exclude the rear gunner and his armament, be made into a single-seater fighter of greater speed, faster climb, and probably better maneuverability, all due to the decrease in weight. Thus the choice between single-seaters and two-seaters might be briefly stated as the choice between performance and armament. However, the contest between the merits of the two types is not as clear cut as would at first appear. When all aspects of the question are examined it is seen to be quite complex.

The single-seater fighter consists essentially of a small plane so designed as to carry a single pilot together with his primary armament, usually two machine guns, at the highest practicable speed and rate of climb consistent with construction strength requisite for combat maneuvers and endurance requisite for the particular employment for which intended. It may carry light bombs as secondary armament, or other accessory equipment, but every pound devoted to bombs, bomb racks, or increased structural strength for dive bombing detracts from its performance. A single-seater fighter loses its efficiency as such directly as it is altered or made heavier for secondary missions. It is always easy and safe to add weight in peace, but in war there is little doubt that the fighting pilot would be busy looking for pounds or even ounces to cut adrift.

The tactics of the single-seater are by force of circumstances governed by the necessity for obtaining a position of advantage relative to its opponent and of then pressing home its attack with its fixed guns. Against an opposing single-seater it attempts to secure a position behind—on the tail—whence it can shoot without being shot at. Its only defense against surprise attack on its own tail is the unremitting vigilance of the pilot. If it attempts to withdraw, except at superior speed during a favorable opportunity, it has no defense against destructive enemy fire. These conditions definitely prohibit single-seaters from fighting while proceeding along a self-chosen course. They must maneuver and head toward the target to shoot. Even a victorious engagement with enemy planes will prevent or delay proceeding on missions assigned, since fighting breaks single-seater units off from their course.

The single-seater type is tactically an essentially offensive type, so much so that it can not easily cease or attempt to withdraw from the offensive. During the World War this defect of the single-seater fighter was well recognized and two-seaters were extensively used for appropriate duties. Any war-time pilot who ever had the experience of coming home with an enemy flight on his tail was convinced of the comfort to be

found in having a rear gunner to afford some show of resistance. In peace time the single-seater is the more spectacular and impressive type and its weaknesses are not exposed, while the inferior performance of the two-seater is readily apparent.

The design characteristics of a two-seater fighter include high speed, fast climb, maneuverability, a minimum of dead angles of fire, sturdy construction, and the best possible vision for both pilot and gunner. It is usual and desirable for pilot and gunner to be located as close together as possible in order to facilitate communication. Its armament includes one or two fixed, synchronized guns and a single or double free gun mounted aft.

The fighting pilot of a two-seater must have the same qualifications as the pilot of the single-place fighter with possibly a bit more ability to coöperate. The gunner must possess a maximum of knowledge and skill in the use of his weapon, be thoroughly at home in the air, and be of a most alert and aggressive type, the secret of successful operation lying in coöperation and confidence between pilot and gunner.

A very definite point of superiority for the two-seater type for certain missions lies in the fact that performance equal to that of the single-seater having been sacrificed in favor of armament, a very slight further sacrifice of performance permits of a marked increase in endurance, thus permitting two-seaters to be used as escorts and covering attack flight in connection with long-distance bombing flights or other attacks requiring endurance beyond that of the single-seaters.

The two-seater type, since it carries two men, can be relied on for more accurate navigation, an important factor in fleet operations where single-seaters sometimes have a tendency to become confused as to their position.

The definitely superior characteristic of the two-seater is, however, the free gun and its inherent ability to fire at the enemy regardless of the course of the plane. This ability enables a unit of two-seaters to fight a defensive action successfully, to retreat at will, or to cover the withdrawal of other units while maintaining an effective relative position. Moreover two-seaters in the attack on slower types are able to deliver effective fire from their rear gun while recovering from an approach firing the front gun, or if desired, to assume a position more or less steady with relation to the target, on a favorable bearing, and pour in a steady fire from the rear gun.

The great disadvantage of the two-seater fighter type as it exists at present lies in the inefficiency of the service type of rear gun and gun mount, particularly at the speeds and under the conditions of aërial combat. With planes diving at speeds near their terminal velocity and changing direction even slightly, the wind blast and forces of acceleration produced render it nearly impossible to operate the rear gun. If the exchange of performance for armament is to be worth while, both ordnance development and the skill and training of both pilot and gunner must make the additional armament effective.

While the two-seater fighter will never replace the single-seater type it is certain that it, as a type, has a definite field of usefulness and that squadrons of two-seaters will be found necessary parts of a balanced air force, afloat or ashore, until further developments in the aëronautic art introduce a superior type.

The fleet air arm of the British Air Force has recently procured a number of Fairey two-seat fighters whose rear gun is carried on a special high-speed mount. While specific performance data are not available, this type is understood to be quite successful. Probably the best known of all two-seater fighters is the famous Bristol fighter which, designed by Captain Frank Barnwell, was recognized during the war as being an unusually effective and efficient type. It functioned splendidly under war conditions on the Western Front and in Palestine. The present model, the Bristol 101, attains a speed of 150 m.p.h. and climbs to 10,000 feet in 9.5 minutes with a 450-hp. Bristol Jupiter air-cooled engine.

A very interesting two-seater fighter monoplane, the K-47, has recently been produced by the Swedish Junkers works. With a 420-hp. Bristol Jupiter engine this plane attains a speed of 150 m.p.h. at ground level and climbs to 10,000 feet in 6.4 minutes. The rear gunner sits facing aft in a rocking carriage seat which is movable in a vertical plane from 0° to 90° elevation while the gun may be traversed 18° on each side of the center line. Great ease of manipula-

tion is claimed for this mount since the gunner and gun mount maintain a constant relative position and the necessity for struggling with a clumsy Scarff ring and assuming queer attitudes in a terrific air blast disappear.

Numerous other two-seater fighters are under experiment or are in service abroad. Moreover foreign investigation goes further than the two-seater and in the past year or two several multi-seaters have appeared. In fact, a strongly developed tendency exists in foreign air forces to favor the introduction of "air cruisers" or heavy multi-seated fighters such as the Bleriot 127 or Swedish Junkers K-37. M. René Sologne in *Les Ailes* says:

> I recently visited the Technical Experimental Works at Villacoublay, and was shown around by one of the leading pilots of the establishment. As we were looking at a Bleriot 127 he said that he had piloted a fighter in the war but that he could not imagine himself attacking the Bleriot in it, and he further remarked that this new heavy type probably meant the end of the old fighter. A month later I heard a similar opinion expressed by one of the oldest pilots of the Thirty-fourth Fighting Squadron. This made me wonder which type would, in the future, hold the field, the old fighter or the air cruiser. The function of the fighter was to maintain supremacy in the air, and in the Great War it acted as an attacking as well as a protective arm. But could it wrest this supremacy from enemy aircraft such as the Bleriot 127? A single-fighter, no matter how well it might be maneuvered, would have no chance whatever of success against the heavier type; it would certainly be overwhelmed. In my opinion, the air cruiser is a machine which will become indispensable to any nation that wishes to be in the position of a real air power. It is the aëroplane of the future.

Similar opinions have been expressed by other foreign experts. Such opinions will be thought unsound by many, and over-enthusiastic by most service pilots in this country, but at the same time they furnish much food for thought. Certain it is that the multi-place fighter idea furnishes a possibility for adapting commercial types to military use in emergency and this consideration alone might justify experimenting with the type for shore based air forces. The adaptability of commercial types to military use can, of course, be increased by design just as ocean liners are designed with a view to possible military use. In fact the potential value of large commercial airplanes for military purposes is the subject of a paper recently prepared for the preparatory disarmament commission of the League of Nations by Brigadier General P. R. C. Groves (See page 864). He points out that not only are the planes capable of conversion but also that "the pilot of the air line is incontestably an aviator of the first rank," flying as he does regularly day and night in all sorts of weather. Certainly the air cruiser is not adapted to shipboard use as will be seen from the following description, but its strength and weakness should be studied by fleet aviation personnel if only as a possible enemy weapon.

The Bleriot 127 which is a good example of the heavy fighter is a large monoplane; wing span, 73 feet; weight loaded, 9,820 pounds. It is powered with two 500-hp. Hispano-Suiza engines in nacelles under the wings. The tail of each engine nacelle forms a gunner's cockpit while a third gun mount is formed in the nose of the fuselage. Each cockpit carries twin Lewis guns.

The Junkers K-37 mounts two fixed guns firing forward, a twin Lewis forward, a twin Lewis aft, and a bottom gun under the fuselage. The fixed machine guns may be replaced by a 2-cm. quick firer. The plane is reported to make 149 m.p.h. and this speed combined with its heavy armament should make it a formidable weapon.

If, in the future, a fast multi-seater fighter is developed with the ability to cover long distances and to develop powerful gunfire from an armament including heavier and longer range weapons than those in use today, it may well be that the type will become a serious factor in aërial warfare. At present it is an interesting experiment of great promise.

The upshot of the question of fighter types seems to be the continued use of single-seater fighters for offensive operations and the use of two-seater fighters for missions where ability to fight while withdrawing or while covering other units is a necessity. Since the two-seater fighter represents the sacrifice of performance in favor of a flexible rear gun, it is evident that this success and development of the type will depend largely upon the development and improvement of free guns and mounts suitable for use under the extremely arduous conditions of speed and acceleration which obtain in aërial combat between modern high performance airplanes.

Should *the* Government *of* Samoa be Changed?

By Lieutenant Commander Stewart F. Bryant, *U. S. Navy (Retired)*

I. Introduction

THE Seventieth Congress has recently taken up a colonial problem of particular interest and importance. It concerns the advisability of placing all colonial matters under the administrative supervision and direction of one bureau or department of the government. Alaska and Hawaii are not included in this proposal. Public Resolution No. 108 approved March 4, 1929, which embodies this proposal, also calls for the preparation of a plan of organization for such a bureau.

In Senate Document 1095 of 1929, a joint commission on insular reorganization finds that in the administration of our dependencies there is "unnecessary expense, duplication of effort, and confusion of action" by having separate departments cognizant of these matters and that neither greatest economy nor highest efficiency results from present conditions. Senate Bill of May 10, 1929[1] further appoints a commission of two senators, two congressmen, and two Samoan chiefs to report upon such legislation as is considered necessary and proper for the islands known as American Samoa.

II. Principles of Colonial Administration

Prior to the consideration of a suitable type of colonial government for a particular subject it is pertinent to outline the general requisites and principles of colonial government. They are listed as follows:[2]

(a) The maintenance of peace.

(b) The protection of health.

(c) The development of education adapted to social environment without attempt to bestow upon backward races those elements of higher civilization which cannot be understood and which may react as social poison.

(d) The encouragement of industry suited to the needs of the people, commencing with work "from the ground up."

(e) Maintenance of respect for the ethnical, psychological, and social character of the people.

(f) The free exercise of native religious tendencies.

(g) Financial measures for the benefit of the colony and not the mother country, prohibition of exploitation. Benevolence rather than profiteering. Financial self-support for each colony.

(h) General preservation of a type of civilization suited to people, resources, and climate.

(i) A system of justice to uphold law and order that receives public respect without resentment.

(j) Creation of adequate means of communication.

(k) Adaption of any uniform system of colonial administration to meet the needs of the particular colony.

There are other considerations to be mentioned. A central government must be careful not to dwarf the personality of the governor by petty supervision and detailed instruction, for the governor must, as the man on the spot, be left in position fully to develop his powers of originality and initiative. The task of colonial officials in "leading without coercing," and in "advising without imposing" is one of no mean proportion. It perforce calls for men of exceptional training and broad education. To secure and maintain capable officials and honest administration, governments must

[1] *Congressional Record*, LXX, 3411.

[2] (a) Paul S. Reinsch, *Colonial Government*, and *Colonial Administration*.

(b) Sir Henry Heskith Bell, *Foreign Colonial Administration in the Far East*.

(c) Report of the Special Mission on Investigation to the Philippine Islands to the Secretary of War, 1921.

trust more to character already manifested before appointments are made, rather than to checks while in office.

In the history of colonial administration there are sufficient records to indicate the injudicious measures, misguided efforts, and lack of understanding resulting from careless selection of officials. The results at times have entailed miseries and hardships on helpless peoples with consequent embarrassment and burden to home governments.

Two important factors should also be added: first that no promise of increased autonomy should ever be made to a subject race until the time has arrived to grant it, and second that neither government nor governor should be placed in a position of responsibility without adequate authority.

III. Samoa and Its People[3]

American Samoa comprises a very small group of islands wherein some 9,000 inhabitants, practically all Polynesians, have been sheltered under our flag for twenty-eight years.

The people are, in general, peaceful, kind, proud, generous, hospitable, and intelligent. They are fond of music and dancing and are deeply religious. The writer still pictures, from an evening walk in Tutuila, some of the villagers lying on their mats reading their Bibles by candle light.

The Samoans have few wants, no particular desire for wealth, no factories, and their industry is chiefly centered in the production of copra. There is a small amount of mat weaving, woodwork, and boat building. Their earning power is extremely small.

The warm climate naturally results in lassitude and an easy-going attitude, that extends in more or less harmless form to primary moralities. At the same time the Samoans hold fast to traditions of the past.

They are in particular need of medical care and will always require thorough protection against (1) epidemic diseases, (2) liquor and narcotics, (3) commercial exploitation. There is no special need for the development of additional industries, even though taxes at present are not sufficient to support costs of administration. Self-support stands as a stable goal to be attained.

To anyone familiar with the Polynesian races there is no point in emphasizing the havoc that can be wrought among them by the inception of a disease such as influenza.

There is little need or place for higher education. What our civilization refrains from bestowing upon simple folk may be just as important as the imposition of doubtful blessings.

Care is necessary in regard to Samoan customs. For example, their graves are usually placed around the family thatch. Any attempt to establish community graveyards would cause trouble, in that the family graves are regarded as proof of land ownership.

The half-castes are a source of potential disturbance. There is little work of a type to satisfy them. An increase in their number will increase the ranks of agitators.

In dealing with these people it is well to remember that they voluntarily gave themselves to American protection and guidance. As a result they do not consider themselves a subject race but entertain the desire to be regarded as a corporate part of America.

The value of Samoa to the United States can be summed up under naval considerations. The island of Tutuila contains a small and well-protected harbor holding an advantageous position on our southern strategic line of communication to the Philippines. This harbor, while one of the best in the South Seas, is nevertheless entirely too small to shelter a fleet. It could serve as a secondary naval base in war time. The terms of the Conference on the Limitation of Armaments at Washington, 1921-22, require that the *status quo* with regard to fortifications and naval-base facilities be maintained. Samoa has not been fortified. At present the Navy maintains a hospital, a radio station, and a fuel depot that is used occasionally.

Samoa is also used as a fortnightly stopping place for a commercial shipping line plying between San Francisco, New Zealand, and Australia.

IV. Naval Administration in Samoa

Before summarizing the present conditions of Samoan government a brief review will be made of certain steps of naval interest leading to the present status.

As far back as 1872 Commander Richard Meade, U. S. Navy, in command of the U.S.S. *Narragansett*, visited Pago Pago and

[3] *American Samoa, A General Report by the Governor, 1926.*

drew up an agreement with the natives which granted the United States an exclusive privilege of establishing a naval station in that harbor. The President and the Senate hesitated to pledge to Samoa protection and no action was taken on the agreement.[4] In 1878, by a Treaty of Amity and Commerce, the right of the United States to establish a coaling station at Tutuila was granted.

In 1899 came the tripartite convention dividing external interests in Samoa between Germany and the United States, with Great Britain relinquishing her claims in return for other concessions. Of this convention a report of the Secretary of the Navy, 1923, states:

> There appears to be nothing in the foregoing treaty to indicate that the government or representatives of the Samoan people had any part in its formation, conclusion, or adoption.[5]

An executive order of February 19, 1900, by the President of the United States clarified the position of America to other interested powers:

> The islands of Tutuila, of the Samoan group and all other islands of the group east of longitude 171 west of Greenwich are hereby placed under the control of the Department of the Navy for a naval station. The Secretary of the Navy shall take such steps as are necessary to establish the authority of the United States and to give the islands the necessary protection.

It is recorded that on April 12, 1900, the high chiefs of Tutuila without solicitation ceded the islands of Tutuila and Aunuu to the government of the United States.[6]

> For the promotion of the peace and welfare of the people of the said islands for the establishment of a good and sound government, and for the preservation of the rights and property of the inhabitants of said islands.

The deed of cession held in the Navy Department also states:

> Ceded, transferred, and yielded up to the . . . . representatives . . . . of the United States government . . . . to erect the same into a separate district to be annexed to the said government, to be known and designated as the District of Tutuila.[6]

On July 14, 1904, chiefs of the remaining eastern islands of the group agreed to cede absolutely and without reserve to the United States all rights of sovereignty of whatsoever kind.[7]

Executive recognitions of these cessions were, however, confined to expressions of greetings and appreciation, stating also that the local rights and privileges of the natives would be respected.[8] In the meanwhile all civil, judicial, and military powers have been vested in a naval governor, under the direction of the President. On April 10, 1926, the Lenroot bill[9] was advanced to provide that all these powers should be vested in the President of the United States, to be exercised by a governor appointed by him and confirmed by the Senate. The bill also provided a district judge to whom writs of error and appeal would be allowed from the inferior courts, with writs of error and appeal allowed from the district judge to the Circuit Court of Appeal for the Ninth Circuit. The bill further stated in substance that the dictatorship existing in Samoa is contrary to American ideals. The Lenroot bill did not survive. We find in the New York *Times* of February 15, 1926, a statement to the effect that President Coolidge was not in favor of proposed changes in the government of Samoa.

The status of Samoa recently, has been cleared of its indefinite nature by the Joint Resolution (S. J. Res. 110) passed May 10, 1929, which states: "Resolved that said cessions are accepted, ratified, and confirmed as of April 10, 1900, and July 16, 1904." This resolution gives to the Samoans a long-desired formal recognition, and brings us to the proposed bureau of administration and the Samoan commission previously discussed.

Let us now examine the disadvantages of the situation in Samoa. The naval governor has made and enforced his own laws. He has been in control of executive, legislative, and judicial functions. This position was brought about by executive order and not by the naval establishment. Let us remember also that all of the governor's acts are subject to review not only by the Secretary of the Navy but also by the President as commander in chief of the Navy. American ideals are not expressed in Samoa's form of government, it is true, but we are not

[4] *American Samoa. A General Report by the Governor*, 1926, hereafter cited as Governor's Report, 1926.
[5] *Congressional Record*, LX, 7255.
[6] *Governor's Report*, 1926, p. 47.
[7] *Ibid.*, p. 49.
[8] *Ibid.*, p. 49.
[9] *Congressional Record*, LXVII, 7254-56.

governing the same type of people in Samoa as live in the United States.

We should note here the clause in the deed of cession of April 17, 1900, which has been followed out:

> The chiefs of the towns will be entitled to retain their individual control of the separate towns . . . subject to the supervision and instruction of the said government.

It has been claimed that dependent people of political immaturity are best ruled by a form of benevolent despotism. That may be so, as long as the benevolent factor can be assured. A review of available documentary and periodical material on American Samoa does not indicate any lack of benevolence nor is there shown any injurious instance of despotism. There are accounts of arbitrary acts, there has at times been considerable agitation among the natives, and there is evidence of the failure of a certain few officers to measure up to acceptable standards.[10] These delinquencies, however, do not seem to affect fundamentals in the system of government.

We must make due allowance also for a climate that unavoidably brings out nervous defects of the white man in a manner that is bound to result in occasional casualties to any type of governing officials. The solution lies in a quick remedy of the situation when found, careful selection of personnel detailed for tropical duty, and reasonably short tours of service.

It has been said that naval officers receive no special training in colonial administration. It is true that no special instruction in colonial administration is given at the Naval Academy. It would be useful to have such a course included in the graduate school of the line or at the War College. In the fleets, however, officers are daily thrown into intimate contact with administrative problems. In the Battle Fleet with a personnel of some 35,000 there is administrative experience of particular value available in law, sanitation, finance, supply, engineering, and communication.

After realizing that the richest nation in the world has no school for colonial training one is led to think that the Army and the Navy may, for the time being, provide a substitute. It may also be added that the military services present opportunities for selection of administrators from fairly large groups of men who have had wide experience at home and abroad.

The following reforms for Samoa have been under discussion. Some of them have been requested by the natives.

(a) Strengthening of the judicial system.

(b) Detail of supplementary civil administrators.

(c) Improvement in public schools.

(d) Increased representation of natives in government.

(e) Higher wages in government minor positions; wages that compare favorably with those received in Hawaii.

(f) Definite annexation to the United States.

(g) Steps to better preserve the native customs.

Some of these reforms have already been effected. There are none that cannot be taken in hand.

There is a lack of funds for additional American school teachers. The native teachers, while loyal and faithful, lack the basic knowledge and technical qualifications. There has also been need for an agricultural expert as plantation inspector.

The few half-castes present a problem because of their dissatisfaction with native occupations and the unavailability to them of the clerical and minor jobs that might be found in a larger colony. A few sons of native chiefs have been sent abroad. The results have not been helpful.

Let us now turn to the advantages of the existing form of administration. There have been no internal wars. The population since 1900 has increased about 53 per cent, a record unsurpassed in the South Seas.[11] Health conditions have been enviable. The epidemic of influenza that ravaged Tahiti and the New Zealand Mandate was excluded from American Samoa by medical restrictions that, even if arbitrary, were highly effective.

The Navy has had a large number of medical officers trained in tropical diseases whose services have been of paramount

[10] *Governor's Report*, 1927, p. 58. See also list of periodical material on these subjects under Bibliography.

[11] *Governor's Report*, 1927, p. 9. See also Chester H. Powell, "An Insular Possession" in *The Survey*, XLVII, 525. Frank Bohn, "The White Man's Burden in American Samoa," in *Current History*, XIX, 651-6. Margaret Meade, "Americanization in Samoa" in *American Mercury*, XVI, 264-70.

value in Samoa. The widespread elephantiasis was literally "cut" out of the people. Venereal disease has been kept down to a remarkably low extent.

Taxes have been low. In 1926 the poll tax was $6.00 and the school tax $3.00.

One of the most important laws that has been maintained allows the natives to buy and sell all land among themselves, but prohibits their selling it to foreigners. The government also prohibits the leasing of land for timber or mineral exploitation. The general policy has been Samoa for the Samoans.[12]

Frank Bohn, writing for *Current History*, January, 1924, says:

> The possession of the soil is guaranteed to the Samoans forever. The white man's poisons, his opium, alcohol, patent medicines, and commercialized drugs, are rigidly prohibited.

Our chief problem is not so much what we cautiously give to these people but what we guard them from—disease, liquor, narcotics, and commercial exploitation. The last usually brings the others. In this problem a naval government finds its highest opportunity for service by being free from political handicaps and commercial interests.

V. Comparisons

In a search for profitable example to be applied to American Samoa we should look for an island group of the same race with the same approximate population. Also a dependency involving special naval interests. It is quickly evident that the Mandate of New Zealand is the only island group from which direct comparison may be made. Even in this case we find a mandate government and absence of special naval or strategic interests.

The governor of "Eastern Samoa" is under the Minister of External Affairs of New Zealand. The civil administration is in general made up of a legislative council of four to six "unofficial" members, three of whom are elected. They must all be natural-born British subjects of European descent born in Samoa. There is also a native council that advises the governor.[13]

The population is close to 43,000. The natives number some 39,000.

Available material on this island group indicates setbacks as well as progress. In 1918-19 it appears that 7,000 of the natives were wiped out with influenza.[14]

In 1923 an attempt was made to improve the copra trade with a non-profit basis for the government and to enforce liquor restrictions. The final result was unrest among the natives, with boycotting and armed meetings. It became necessary to send two cruisers to the island for suppressive purposes. A native chief was given a jail sentence in New Zealand and the wealthiest white trader was banished from the islands for five years.

The Mandates Commission of the League of Nations reports as follows:

> The Commission noted . . . . that the passive resistance organized by the "Mau" acts as an obstacle to the Administration and has gone so far as to paralyze its action in some departments. . . . . The continuation of this unrest will result in a very serious check to the prosperity of the country.[15]

On the other side is should be emphasized that New Zealand inherited conditions that foretold difficult problems and that the Mandates Commission, after careful investigation in 1928, reported that charges against the New Zealand administration were unfounded and that they had originated with a disgruntled European trader. It appears that in the non-profit plan for handling copra this trader would have lost considerable profit as a middleman. The commission added that the "local administration seems to have made every effort to improve the life of the native population."[16] One member of the commission pointed out the great value of instituting classes for white officials to study the language, customs, and the system of native legislatures in Eastern Samoa. We find an interesting supplement to this idea in the policy of the French in Indo-China in training administrative assistants to go among the natives and lecture to them on subjects of practical value in agriculture and sanitation, exercising great caution at the same time in disseminating impracticable ideas of political progress.

[12] An illuminating article, "Americanization in Samoa," may be fund in *American Mercury*, XVI, 264-70, March, 1929.

[13] *Statesman's Year Book*, 1928.

[14] *Current History*, XIX, 655.

[15] League of Nations Permanent Mandates Commission. Minutes of the Fourteenth Session, 1928, p. 274.

[16] League of Nations Permanent Mandates Commission. Minutes of the Thirteenth Session, 1928, p. 230.

The remarks above on New Zealand administration are intended to bring out the pitfalls in commercial developments, and not in any sense as a reflection on the method of handling the problems imposed.

In the Society and Marquesas Islands of French Oceania, a governor is in general supervision who comes under the French Cabinet Minister for the Colonies. The total population of these islands is about 36,000, of whom some 30,000 are natives. In Tahiti, the principal island, there is an administrative council of six members.[17] These dependencies are about as far away from France as any islands could be. They are of no strategic interest and of relatively small commercial value to the home country.

Heavy toll of life was paid to the influenza epidemic at the end of the World War.

France has a large and well-trained service of colonial administrators from which to draw. These particular island groups are, however, relatively unimportant as compared to other French colonies.

The *Americana*, 1925, gives the following:

> The vices introduced by contact with civilization soon brought about moral and physical degeneration and the natives are rapidly diminishing in number.

Other accounts indicate improvement in recent years.

The Japanese mandated islands in the Pacific were taken from Germany in October, 1914, and first garrisoned with Japanese naval contingents. In December of the same year a naval administration was set up with the islands divided into six groups. In April, 1921, the mandatory form of government was installed under naval supervision with civil assistants. In 1922 a South Seas bureau was established with the headquarters of a civil director at Korol in the Palau Islands.[18] This director comes under the Prime Minister of Japan. Matters concerning communications, however, are put under the Minister of State for Communications, those of finance under the Minister for Finance, and those that pertain to agriculture under the Minister of State for Agriculture and Commerce. With the establishment of the civil bureau the naval garrisons were abolished.

The judicial system has three courts to serve as courts of first instance and for criminal cases, and a high court to review cases on appeal from the local courts and to serve as a court of last resort.[19]

In the records of the Mandates Commission of the League of Nations we find that the commission hoped to find in a subsequent report why grants were reduced to encourage native economic development; noted that the proportion of children of ages between eight and eleven not attending school did not seem altogether satisfactory; and was concerned with the decrease of population of Yap.[20]

Other reports indicate that hospitals have been established for the natives, sanitation has been generally taught, and education has been well concentrated on agriculture and industrial arts. We also have indications that judicial standards have been high, that there is no forced labor, that traffic in arms has been controlled, and that the restrictions on alcoholic liquors have been reasonably well enforced.[21]

VI. The Proposed Bureau of Insular Possessions

There are several considerations which show the gravity of any broad change in colonial administrations until means of improvement are assured. One of the best outlines of these considerations may be found in a recent book by Sir Henry Hesketh Bell, an experienced British colonial administrator. His book entitled *Foreign Colonial Administration in the Far East* takes up the following factors as leading towards "visionary and intoxicating political ideas" among dependent peoples:

(1) The results of the Russo-Japanese War.

(2) The high degree of responsibility and the unusual example set in the Philippines.

[17] *Annuaire Colonial*, 1927, p. 1753. *Annuaire Générale*, 1928, p. 828.

[18] Japanese Government's Annual Report on Mandate Territories to the League of Nations, 1925, p. 2.

[19] Japanese Government's Annual Report on Mandate Territories to the League of Nations, 1922, p. 2.

[20] League of Nations' Permanent Mandates Commission, Minutes of the Fourteenth Session, p. 273.

[21] Luther Harris Evans, *The Mandates System and the Administration of Territories under C Mandate*, Stanford University Library.

(3) The nationalist movement in India.
(4) The slogan of self-determination of all peoples.
(5) The turmoil in China.
(6) The repercussion of the World War.
(7) The malignant propaganda of communists in educational and trade centers.
(8) The injurious effect of moving pictures.

As for this last item there seems to be no other influence which has done as much to diminish the prestige of the white man in their colonies. Police reports from Dutch colonies have attributed new developments in more serious and complicated native crime to the cinema. Even the posters outside the show halls have helped to break down the attitude of reverence and respect for the white man.

With regard to our policies in the Philippines it is more probable that contrasting influences have been the cause of increased burdens in other colonial areas of unrest.

Mr. Thomas Millard states, after his visit in India, that he found the British in that empire, both in and out of the government, in a state of subdued rage about what the Americans were doing and proposed to do in the Philippines. In his book on *Conflict of Policies in Asia*, he says: "I found that they regarded the introduction of American policy into Asia as an unmitigated disaster"; and that "the extension of American political institutions and ideals to the Philippines was regarded as equivalent to throwing a political firebrand into Asia."[22]

For the British to apply Philippine policies to India would mean ultimate bankruptcy from a financial point of view, and while political experimentation may be costly enough for America it involves penalties of far more serious aspects for Britain.

There is enormity and danger in colonial problems as a whole today. The British, French, and Dutch alone have to control more than one-third of the earth's population. The basis of strength in their control lies in the character and training of their representatives. Let us examine therefore the colonial college systems of some of these countries. At Leyden the Dutch have a course of thorough training lasting up to five years. The colonial service is held in high esteem.

The results and policies of the Dutch are outlined in Reinsch's *Colonial Government* (p. 136) as follows:

> The Dutch in Java have proved themselves great adepts in the art of utilizing native institutions for the purpose of colonial government. The protectorate there has completely lost all vestiges of its international character and has become purely a method of internal administration. The policy of non-interference with native customs and institutions, however, is scrupulously observed, and everything that might lead to a disintegration of native society is carefully avoided. Not only are the reigning families made secure in their position, but any attempt on the part of the natives to assimilate themselves to the Europeans is discouraged. Their continued adherence to the Mohammedan faith is in every way encouraged and in general the religious "adat" or custom has been preserved as a bond of social union. The complete hierarchy of native officials, from the "emperor" and regents down to the local administrators and the village chieftain, is still in existence and presents to the eyes of the natives historic continuity and customary authority.

The Dutch have refrained from overeducation. An excess of supereducated natives too proud to continue the work of their forbears results in unemployed and dissatisfied candidates to swell the ranks of the communists and disturbers of the peace.

The French *Ecole Coloniale* provides a course lasting up to three years with special training available in the languages, resources, industries, customs, law, and economic geography of their colonies.

There are four departments in the school, one for administration, a second for judicial candidates, a third for specialists such as in agriculture, and a fourth for the training of natives sent from the colonies. Unfortunate results have to be reckoned with in sending natives to Europe, as they sometimes return corrupted with communistic and revolutionary ideas with which they stir up native feeling.

The French college has some twenty-five lecturers and professors. An excess of more than 30 per cent of students is carried to allow for weeding out. Particular attention is paid to the traditions of the colonial service.

The Colonial Department in France tries to standardize administration by division of its functions into four general groups, roughly as follows:

[22] *Congressional Record*, LXX, 3411.

(1) Political, administrative, and judicial.
(2) Agriculture, commerce, industry, customs, forestry, fisheries, communications.
(3) Colonial civil servants.
(4) Military, police, medical.

There is also a corps of *Inspecteurs des Colonies*, usually ex-governors, who have a highly delicate task. There is a consultive commission also made up of experienced governors who usually serve without pay as an advisory body to the minister. In the government there is also a *Conseil Superieur des Colonies*. The influence of these three special groups is somewhat weighty upon the colonial governors. We find indications that financial and political interests have been involved with undue interference with men "on the spot."

To quote again from Reinsch's *Colonial Administration* (p. 300):

> As a matter of fact there is no body or institution less fitted to govern colonial dependencies than the home legislature which lacks almost all knowledge of colonial conditions and looks at all colonial questions from the point of view of party politics within the home country. The French object to a monopoly of colonial legislative power in the hands of the executive. A few of them see that the better solution of the difficulty would be found, not in the direction of added parliamentary interference, but in giving greater autonomy in legislative matters to the local government in the respective colonies. . . . . The colonial ministry at home has its proper function in guarding and supervising, but not in origination and framing this legislation.

Our American Congress has been far-sighted in allowing our dependencies to be kept relatively free from such handicaps.

As a smaller factor to be mentioned, the French have found it advisable and beneficial in spite of extra expense to establish good schools for white children in their colonies.

One of the outstanding and useful policies of their colonial system lies in drawing up in the home offices general plans of broad developments in their colonies for years ahead. If the plans are definite and sound it is fair to assume that stabilizing influences of benefit will result for their colonies.[28]

In the British system there is a special point of interest. It has been said that a type of successful Englishman is the one who goes out of his country for service and then returns, to find useful position. In America life is so much more attractive and so luxurious, and opportunity so vast, that endeavor is nearly all concentrated within the home grounds. Service in colonies implies exile from home and from most of the things which make American life so agreeable.

We shall always have this to contend with. It is difficult to imagine how our young men can be taught to realize that wealth and education involve an obligation to give national or commercial service abroad as well as at home. Yet we are going to have great need of that doctrine, more and more as the years go by. And particularly so for the able college man who is also the gentleman, the sportsman, and the man who has received the highest type of training for work abroad.

A bureau of insular possessions appears to carry with it responsibilities and problems of consequence, difficulty, and expense. It must perforce be carried through its initial spasms by men of wide training and by men who can profit by the broad experience of other colonial powers.

VII. Conclusion

The United States has a somewhat different set-up in its colonies than other powers. To begin with, we are in no way really dependent upon our colonies for food or protection. Also each one of our outlying possessions seems to have a special issue aside from our benevolent interest in each one.

In Samoa we have a paramount naval interest. The same applies to Guam. In the Virgin Islands a commercial interest begins to apply along with the naval. At the Panama Canal the Army interest is paramount due to the engineering requisites and the vital necessity for immediate military control in emergency. In Porto Rico we have commercial and minor naval interests. In the Philippines we have larger commercial interests, a naval base, and important military interests involving not only defense, but a necessary force that for years to come will be required on hand as a stabilizing influence between the Christian Filipinos and the Moros.

[28] Data on the Dutch and French Colonial Colleges are mainly derived from Sir Henry Hesketh Bell, *Foreign Colonial Administration in the Far East.*

The question immediately arises as to the advisability of a civil bureau to administer a mixture of naval, military, and commercial paramount interests. If we are going to standardize a colonial service and eliminate "duplication of effort and confusion of action" will it not become wise and necessary to create well in advance a colonial college to train the proper administrators? There will not be financial economy in that measure. To obtain the ablest men will require high pay. The resulting political economy might be very great in the long run. We must remember also that the military and naval forces would still have to be maintained in addition to the civil administrations.

Any change in Samoa is in great measure dependent upon the general plan. That is why this discussion has been extended to include it. Even with the adoption of this new plan, Samoa has a special situation of its own. A naval station should certainly be maintained there as long as we are responsible for the Philippines. The extra task of administering to the cares of a group equal to the personnel of eight battleships is not a large one and would appear to be a simple measure of economy. It would seem better to supplement the administration with judicial and other assistants as needed rather than remove a form of government that in emergency should have complete and immediate control.

In any event the colonies of a nation stand as international advertisement of the character of its people and of its government. As such they deserve our deepest consideration in providing for them the most efficient kind of administrative guidance.

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Courtesy Mrs. Llewella Pierce Churchill

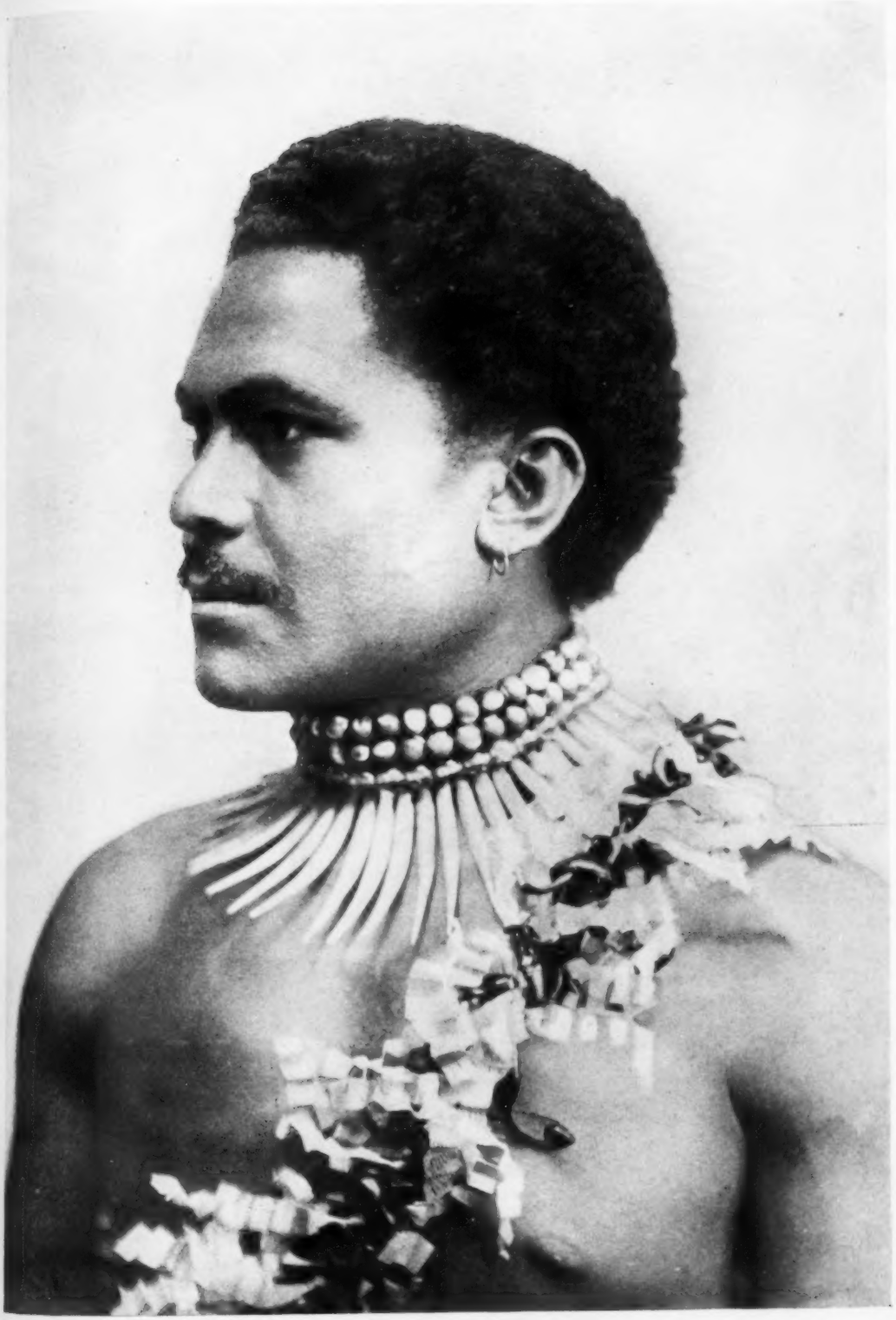
FALE TELE OR GUEST HOUSE OF THE NATIVE VILLAGE OF VAIALA

UNIV. OF MICH.

Courtesy Mrs. Llewella Pierce Churchill

SAMOAN BELLE

This is a picture of a native belle, a *taupo,* of the village of Vaiala.



Courtesy Mrs. Llewella Pierce Churchill

SAMOAN BEAU

This is a picture of a *manaia* or beau of the village.

UNIV. OF MICH.

Courtesy Mrs. Llewella Pierce Churchill

IN THE HARBOR OF APIA, SAMOA

A native pleasure boat of a Samoan village decked out in gay colors and manned by many oarsmen. The occupants are taking their guests to the steamer bound for San Francisco.

their guests to the steamer bound for San Francisco.

International Newsreel

MAORI WAR CANOE ON LAKE ROTORUA, NORTH ISLAND, NEW ZEALAND

UNIV. OF WICH.

Courtesy Bureau of Navigation, Navy Department

A SAMOAN CARVER AND HIS HOME

Courtesy Bureau of Navigation, Navy Department

A SAMOAN CARVER AND HIS HOME

Courtesy Bureau of Navigation, Navy Department

A NATIVE SAMOAN HUT

UNIV. OF WICH.

YOUNG SPORTS OF SAMOA, 1925

Courtesy Bureau of Navigation, Navy Department

An Episode

By LIEUTENANT COMMANDER E. W. HANSON, *U. S. Navy*

THE exploits of the Confederate cruisers during the Civil War and their effect on the operations of the Federal Navy are well known to students of naval history. Many episodes of that great struggle remain unknown because they were not properly recorded at the time; others have been so overshadowed by the larger events of the time that although recorded they have not been given the publicity which they would otherwise merit. The following raid on the commerce of the United States belongs to the latter category.

On May 6, 1863, the Confederate cruiser *Florida,* off Cape San Roque, Brazil, captured the brig *Clarence* laden with coffee from Rio for Baltimore. Lieutenant C. W. Read of the *Florida* proposed to his commanding officer that he and Engineer Lieutenant Brown take this brig, man her with twenty men from the *Florida,* make a raid on the United States naval forces in Hampton Roads, and capture a gunboat if possible. As an alternative he proposed to burn the shipping in Baltimore Harbor. The Commanding Officer, Commander J. N. Maffitt, C. S. Navy, approved this proposition, and suggested further that the shipping of Norfolk might be fired. The only equipment that was placed on the *Clarence* was a twelve-pounder brass howitzer with ammunition and some small arms. Thus was commissioned a sea rover that created fully as much excitement from Maine to Hatteras as the depredations of the other and larger Confederate cruisers.

At 6:00 P.M. on this date the *Clarence* and *Florida* parted company, the *Florida* following the coast of Brazil to the south and the *Clarence* bound directly to the stronghold of the enemy. In his report Read tells us of chasing several vessels off the Windward Islands but, owing to inferior sailing qualities of the *Clarence,* he failed to make any captures until June 6 when, two hundred miles east of Cape Hatteras, the bark *Whistling Wind* coal-laden from Philadelphia for New Orleans was taken. Thus one month had elapsed since commissioning. It might well be that Read had not been too keen to harry trade as concealment of his very existence was of the utmost importance to the success of his mission.

Learning from the crew of the captured ship of the many difficulties connected with capturing a gunboat at Hampton Roads, or indeed entering the Roads at all, Read abandoned for the time being his original plan and determined upon a new course of action. About daylight on June 12, the *Clarence,* then being on the Southern Drill Grounds and almost in sight of Cape Henry, captured the bark *Tacony.* This ship was in ballast and better suited for his purpose than the *Clarence;* so Read determined to transfer to her. Before he could effect his transfer, however, the schooner *Mary A. Shindler,* also in ballast, hove in sight and was captured. Later, on the same day, the schooner *Kate Stewart* from Key West to Philadelphia, in ballast but carrying passengers including women, was also captured. This ship was bonded and sent in with the crews of other captured vessels. The *Mary A. Shindler* and *Clarence* were destroyed by burning and a new sea rover, the *Tacony,* commissioned. The brig *Arabella* was overhauled and captured but as the cargo was neutral she was bonded and allowed to proceed.

Capturing four ships in one day and commissioning one of them for further use should certainly be considered a real day's work, but the actual loss resulting from this raid was nothing compared with the furor that it caused in official and commercial circles throughout the Atlantic seaboard. In spite of the difficulties of communication, information of these captures was in the Navy Department by 4:30 P.M. on June 13. (The *Kate Stewart* had telegraphed upon entering Delaware River.) Orders were sent to

the navy yards at Boston, New York, and Philadelphia and to the senior naval officer at Hampton Roads to send in pursuit every ship that could be made ready and to protect commerce. The President of the United States directed the Secretary of the Treasury to use all available revenue cutters in coöperation with the Navy Department. No less than forty-three ships of all classes were sent out after the raider. Ferry boats, tugs, yachts, sailing vessels, and steamers of almost every class were used. The yacht *America* with midshipmen on board was among those dispatched. Notwithstanding all of these, Lieutenant Read in the *Tacony* continued his commerce destruction uninterrupted, choosing his cruising ground and being generally ahead of his pursuers.

On June 15 he captured and burned the brig *Umpire* bound for Boston laden with sugar and molasses. On the twentieth near Nantucket Lightship he captured and bonded the ship *Isaac Webb* with 750 passengers on board. On the same day the fishing schooner *Micawber* was captured and burned. On June 21 he captured and burned the clipper ship *Byzantium*, coal-laden, and the bark *Goodspeed* in ballast. On June 22 he captured five fishing schooners on Georges Bank. One of these was used for sending in prisoners. On June 23 he captured and burned two more fishing schooners. On June 24 he captured and bonded for $150,000 the ship *Shatemuc*. This ship had a large number of immigrants. On the same night the schooner *Archer* was captured.

Read had now expended all the ammunition for his little howitzer and, thinking that he was closely pursued, he decided to descend on an unprotected port, destroy its shipping, and perhaps capture a steamer. These words from his notebook were probably written on June 25:

> The latest news from Yankeedom tells us that there are over twenty gunboats in search of us. They have the description of the *Tacony* and overhaul every vessel that resembles her. During the night we transferred all our things on board the schooner *Archer*. At 2:00 A.M. set fire to the *Tacony* and stood west. The schooner *Archer* is a fishing vessel of ninety tons, sails well, and is easily handled. No Yankee gunboat would even dream of suspecting us. I therefore think we will dodge our pursuers for a short time. It is my intention to go along the coast with a view of burning the shipping in some exposed harbor (and) of cutting out a steamer.

At this time he was about one hundred miles east of Portland, Maine, toward which port he made his way. Early in the morning of June 26 Portland Light was made. The following extracts from his official report give in few words the ending of an expedition the audacity of which has been equaled in modern times by the *Emden* during the World War:

> On the morning of the 26th of June we made Portland Light. Off Portland I picked up two fishermen, who, taking us for a pleasure party, willingly consented to pilot us into Portland. From the fishermen I learned that the revenue cutter *Caleb Cushing* was in the harbor of Portland, and the passenger steamer to New York, a stanch, swift propeller, would remain in Portland during the night. I at once determined to enter the harbor and at night quietly to seize the cutter and steamer.
>
> At sunset we entered the harbor and anchored in full view of the shipping. I explained to my officers what I expected to do after dark. My engineer, Mr. Brown, expressed his doubts as to his ability to start the engines of the steamer proposed to be captured without the assistance of another engineer. I felt confident that Mr. Brown would do his utmost to perform the duty required of him, but as the nights were very short it was evident that if we failed to get the steamer under way, after waiting to get up steam, we could not get clear of the forts before we were discovered. As the wind was blowing moderately out of the harbor, I then decided to capture the cutter and, after getting from under the forts, to return and fire the shipping.
>
> At 1:30 A.M. we boarded the cutter *Caleb Cushing* and captured her, without noise or resistance. As the cable could not be slipped, it was two o'clock before we got under way. The wind was now very light, the tide was running in, and before we could get from under the guns of the forts day dawned.
>
> At 10:00 A.M., when about twenty miles off the harbor, two large steamers and three tugs were discovered coming out of Portland. The cutter was cleared for action, and as soon as the leading steamer was in range we opened fire upon her. After firing five rounds from the pivot gun I was mortified to find that all projectiles for that gun were expended. From the movements of the enemy's steamers it was evident that they intended to attack us simultaneously on each side and endeavor to clear our decks with their sharpshooters. It was plain that we could offer but an ineffectual resistance, and therefore I directed the cutter to be set on fire and the crew to take to the boats. At 11:30 I surrendered myself and crew to the steamer *Forest City*. At twelve o'clock the cutter blew up.

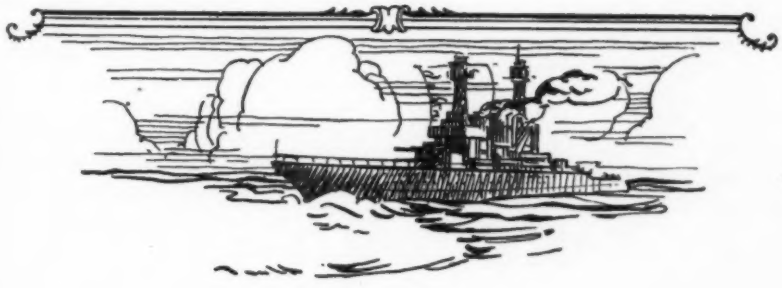
After the surrender of Read and his men it became known that the *Archer* had stood out to sea during the night. She was subsequently captured with three of Read's men and a fisherman on board. She contained

most of the navigational instruments and chronometers of prizes which had been destroyed, but not much else of value had been transferred to her.

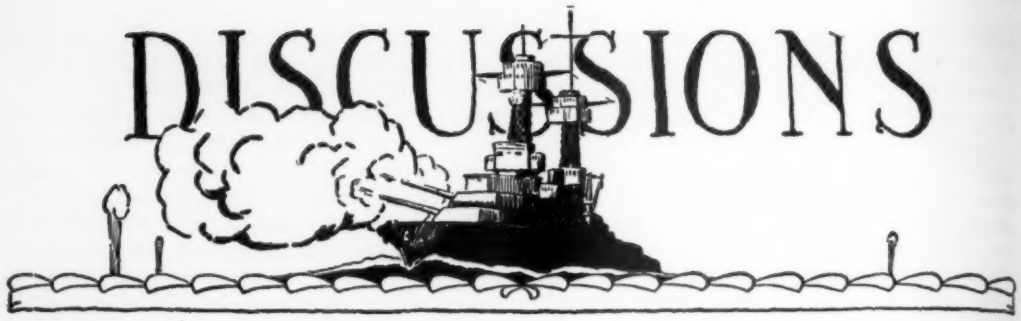
It is interesting to note that the only fatality connected with this expedition was caused by the accidental discharge of a musket in the hands of a spectator on board the *Archer* after that ship's final capture.

The material damage caused by the *Clarence, Tacony,* and *Archer* was not in itself great. The diversion of over forty ships that were sorely needed elsewhere was, however, serious. This was perhaps a greater number than were actually sent out for any other raider. The explanation probably is that the Navy Department considered the *Tacony* as merely an auxiliary of one of the larger cruisers which was believed to be in the vicinity, although this is hardly borne out by the types of ships sent. The realization that a raid of this kind was possible must have engendered a feeling of insecurity which captures on the high seas had failed to do, for we find that subsequently men-of-war were stationed to protect shipping at important commercial anchorages. This sense of insecurity was accentuated by the fact that all available troops in and around New York had been hurried into Pennsylvania to meet Lee's threat which culminated in the battle of Gettysburg. The Department was deluged with letters pointing out the feebleness of defenses. Another result of this raid was that insurance rates went up still higher and still more freight was driven to foreign bottoms. From this point of view the raid was distinctly worth while.

NOTE.—C. W. Read was a graduate of the U. S. Naval Academy, Class of 1860. He resigned to enter the Confederate service in February, 1861. As executive officer of the C.S.S. *McRae* he had seen service on the Mississippi, taking part in the action against the Federal fleet under Farragut when that fleet passed Forts Jackson and St. Philip. During this engagement his captain was wounded and Read automatically became commanding officer. The *McRae* later sank off New Orleans and Read escaped with his crew. After the incidents of this narrative Read was exchanged and served conspicuously in various capacities in the Confederate James River Squadron.



DISCUSSIONS



Possibilities of the Diesel-Engined 10,000-Ton Cruiser

(See page 505, June, 1930, PROCEEDINGS)

CAPTAIN H. C. DINGER, *U. S. Navy (Retired).*—The article is an endeavor to indicate the effect of putting Diesel drive on a 10,000-ton cruiser to show how it can be done and the advantages to be secured. The data presented, however, are in a considerable measure, hypothetical and academic, and some of the information is not the kind upon which actual vessels are designed. Hence the picture of the possibilities of Diesel drive for cruisers calls for some comment. In actual design, it is necessary to deal with actual weights and actual space and volume. The author deals somewhat with assumed characteristics.

The law of similitude used is interesting, but it is doubtful whether it could be used as a basis for actual design. There are too many *ifs* and *ands* about it. The ratios used, while they may be to some extent indicative and informative, would be too uncertain upon which to base actual construction. There is no fixed ratio between weight of gun and rapidity of fire, between horsepower and weight, or between volume of cylinder and weight of engine. There would be if a thousand and one other things remained the same, which they do not. Therefore, curves drawn on the basis of such deductions are not of very much practical significance and are vitiated by any material departure from the assumed conditions. The use of light alloys in lieu of iron or steel parts throws the ratio out of joint. It also will cause a material change in pressure, an improvement in economy, etc.

The author attempts to make weight comparisons in a way that leaves the reader in doubt as to what it is all about. Such terms as fixed engineering weights and weight per cubic inch of cylinder volume are of no particular meaning; nor is it easy to distinguish between propulsive machinery, auxiliary machinery, and ship service machinery, because no definite line exists as to where one begins and the other leaves off. If we have a total weight of machinery that is something more definite—with this figure some comparisons can be made.

After considerable discussion, the paper arrives at a figure 1,079 tons engineering weight and 47.9 pounds weight per shaft horsepower. This is a rational figure for the type of machinery proposed. This figure might have been assumed in the beginning. It is substantially the total machinery weight of the *Ersatz Preussen* and about 60 per cent below weights on our submarines. No other installation on board ship has ever approached this figure. It can, however, be done, if some one wishes to spend the money to accomplish it. The decrease in weight of the *Ersatz Preussen* is largely due to the use of light alloys and special refinement in design. This costs money and also may take considerable toll on reliability.

The upshot then is that if we use the machinery suggested, which has not been fully tried out, we can get an 80,000-horsepower Diesel machinery installation on about fifty pounds per shaft horsepower. If we use the best possibilities of the steam turbo-reduction gear, we can do it on just about one-half of this weight. Modern destroyer installations, which do not make full use of high-pressure steam nor of welding and use of light alloys, have already secured the figure of thirty pounds.

Direct or geared drive.—There is likely to be but little difference in weight here, as the author has indicated. The decision to

use the geared type will be based on other matters. In the case of the cruisers, there is insufficient headroom properly to accommodate direct-connected engines for the power required, namely 20,000 shaft horsepower per shaft. It is hardly practicable to place the engines as they are located by the author. The shaft line is shown too low to make proper connection to propellers. There is insufficient headroom over tops of cylinders and the space at sides is extremely cramped. As it is, the cylinders project well above the water line. Therefore, if we must have Diesels for the cruiser, we will have to use a shorter engine of higher revolutions, say 450, and connect to propeller by means of gears, or use electric drive. This will require more space and perhaps more weight and will make such a complicated installation that it cannot be considered very desirable.

Now, what fuel consumption will such an installation give us? We may perhaps secure 0.5 pound of oil per horsepower for all purposes at near full power. The author's curve on page 510 is, in my opinion, about 10 per cent optimistic. At cruising speed the fuel consumption will go down to 0.75 pound per shaft horsepower at fourteen knots. With a steam turbo-reduction gear of up-to-date design, we can secure 0.55 to 0.6 pound at full power; with Diesel cruising equipment we can get about 0.7 pound at twelve knots. The weight of this machinery will be approximately 60 per cent of the Diesel equipment proposed by the author and its cost will be only about two-thirds of the Diesel. We will have gained a greater radius for the vessel at twelve knots and lessened the radius somewhat at the higher power. But if the weight saved by the steam plant is put into fuel, we can regain this lost radius and more.

Having this picture in mind, and the uncertainty in regard to the reliability of any light-weight Diesel, there is no notable advantage in putting the Diesel in for the main drive. We merely secure the prospect of uncertain reliability and greater expense for a talking point.

The cost of operation of the Diesel, when all things are considered—(1) extra cost of fuel or of cleaning bunker oil, (2) extra lubricating oil, (3) extra repairs and renewals—will probably be greater than with the turbo-reduction gear installation, and materially more if the steam plant is fitted with Diesel electric cruising equipment.

The moderately powered merchant ship of 3,000 to 10,000 horsepower presents a somewhat different picture, so does the yacht and fishing boat, car ferry, etc. There are marine installations where the Diesel is unquestionably the thing. However, it is at a disadvantage in a high-powered cruiser for the U. S. Navy.

The turbo-reduction gear has the following advantages:

(a) Definite reliability—can be operated even with major derangements.

(b) Essentials can all be placed below the water line, except uptakes.

(c) Can be made more compact.

(d) At least 50 per cent advantage in weight.

(e) Better maneuvering qualities.

(f) Operation is well understood by operators likely to be available.

(g) Requires no specially clean fuel and can use any available fuel oil.

(h) Uses *much less* lubricating oil.

Against these advantages, we have a slightly greater fuel consumption at some speeds. This one point is not enough to balance all the other advantages. Furthermore, no actual builder of Diesel engines in this country is now prepared to build the engines that the author presents for our consideration. There would have to be considerable experimentation and development before the engines could be produced successfully. The Navy is now proceeding to determine what Diesel engines may be used for Navy motor boats. Here is where the Diesel has special possibilities, yet there appear to be relatively few Diesel engines of American manufacture adaptable to this class of service. After a period of development and considerable experimental work, Diesel engines satisfactory for such service will be produced. But even here, in this relatively simple application, the problem is actually much more than taking some one's idea of an engine and placing it in a boat.

Punishments Humanized

(See page 582, July, 1930, PROCEEDINGS)

LIEUTENANT H. J. WRIGHT, *U. S. Navy*—Lieutenant Minckler's article on the theory and practice of punishments as exemplified in the Navy touches upon a sub-

ject not only timely and of vital interest to the Navy but also to the nation itself. It is, as he has stated, a highly controversial topic. He discusses the mission of punishment, hindrances in our present naval system of justice to the realization of the mission, and makes a decision to insure the fulfillment of the mission.

The writer takes issue with Lieutenant Minckler on the theory of punishment. He states that the mission of punishment is "to punish in such a way as to obviate the necessity for future punishment." To use an expression of the author, this is but "the elucidation of the obvious." The question to be decided is threefold—shall we punish in order to satisfy a desire for revenge, to deter would-be offenders, or to correct the individual. The author discusses these phases of the question and arrives at the conclusion that the correction of the individual is paramount.

The writer believes that the theory of deterrence is the most effective and practical for the service as well as for the state at large. If we examine the subject in the modern scientific method which is *a posteriori* synthetic—a method which investigates and tabulates a vast number of effects and from these induces a cause—we find that in communities and nations where sharp, summary, and almost Levitical punishment follows swiftly the commission of a crime, the incidence of crime is very much less than where a so-called system of humanitarian penology is in vogue. The incidence of murder in the United States and in England need only be mentioned in passing as an illustration.

From personal experience the writer has seen the salutary effect of a captain's practice at the mast of "soaking" them. The ship was a cruiser with five hundred men aboard. The "Old Man" was a salty, upstanding gentleman of the "old school" and when a liberty jumper or shirker appeared at his mast, he was "soaked"—make no mistake about it. That ship, during the two years of the captain's tour of duty, not only stood one in gunnery and engineering and won the "meat ball" but also stood *one* in the conduct tabulation for ships of her class, having fewer breaches of discipline and fewer summaries than any other cruiser. And it was because a report meant inevitable punishment. That ship was, in addition, what is known in the service as a "happy" one. The captain's attitude was based on sound philosophy—he believed that to molly-coddle the offender was to be very unfair to the men who were manly and played the game. Every division officer conducted his own men to mast and he had to know his men properly to answer the skipper's questions. The deterrent theory was a grand success in that ship. The writer believes that the mission of punishment is to punish in order to deter others and the offender from further breaches of the law.

The author criticizes rather severely the summary court-martial. He says:

> Our legal machinery is complicated and cumbersome; our procedure follows closely that of a criminal court under the civil law. Officers acting as prosecutor and defense counsel are expected to display almost the same learning in legal matters as is expected of a trained criminal lawyer. The members of the court combine the functions of judge and jury.

The writer holds that the naval court is the fairest court in the world. The interests of the accused are safeguarded as in no other tribunal. Why should our procedure not follow that of the civil courts? It is in the main a procedure based on the old common law. It is neither complicated nor cumbersome—there are no continuances, injunctions, and appeals to clutter up the procedure as in civil courts. The main object of the proceedings is to get the facts, and "learning in legal matters" is a drug on the market in a naval court. Spellbinders, "sob sisters," and sea lawyers are soon squelched by a good "senior member."

It is true, as the author says, that there are lists of punishments issued to cover certain offenses—they are but a guide to the court. The writer has "respectfully adhered" to sentences adjudged by his court, which did not follow the schedule but were in accordance with the A. G. N. and the *Navy Regulations*—and the sentences have stood. There is no court worth the paper in its precept that does not try to get behind the obvious facts and delve into the motives of the accused and, learning these, take them into its deliberations.

In his "decision" the author recommends that we do away with schedules of punishment and "let the officer on the spot determine what is best." He suggests delegation to the division officer the power to punish minor offenses; and in serious cases merit-

ing court-martial, a preliminary investigation by the division officer before going to mast.

There is not a division officer afloat worth his salt who does not do just these things. The division officer, in submitting his liberty list to the executive, may omit from it certain names for cause. There are jobs to be done outside of extra duty in the regular course of routine that may be saddled on the shirker to his great disgust; there are baseball teams on which to play; smokers on other ships—many little things that if denied soon wake up a man if he is worth waking. In serious matters at mast the writer's skippers have always demanded an account of the accused and the particular circumstances surrounding the alleged offense, from the division officer, before taking action. The boatswain's mate can get plenty of action from a good division officer in the case of Jones, second-class seaman, who will not turn out at reveille, without punching said Jones in the nose. As a matter of fact the writer believes that the punching petty officer has almost completely disappeared. In fact the main trouble with the modern boatswain's mate is that he is too chummy with the cubs under him.

There are many points made by the author in his article that are valuable and to the point and the subject is, to the writer's mind, quite the most important before the naval service. He believes, however, that the answer to the problem, if there be an answer, lies in the recrudescence of an old specialty that has gone to pot, that of being a real division officer. The graduate engineer, the ordnance shark, the radio wizard, all have their importance aboard ship; but the boy who pounds the tar and the tin receives little help or encouragement. He as a junior division officer gets mighty little in the way of precept and example from his immediate senior in the troubled job of being a good division officer, because his immediate senior does not know how either. And soon the junior becomes the senior—and division leadership remains submerged. The real reason that small ships, such as destroyers, seem to have a higher state of morale than the larger ones is, to the writer's mind, because there is really only one division officer, the executive officer, who is an experiencer, capable officer usually—he has to be to get by in that particular billet.

A Method of Calibrating Range Finders at Sea

(See PROCEEDINGS for February, 1930, p. 137; May, 1930, p. 440.)

LIEUTENANT COMMANDER ALFRED TAWRESEY, *U. S. Navy.*—The method of checking range finders, ably set forth by Commander Parker, and commented upon by Commander Lee, may be further simplified. Commander Parker's equation $R''/S = (B + b)/b$ may be written $R'' = S(B/b + 1)$, or $R'' = S \times N$. If we let r' equal the error in R', and r'' equal the error in R'', and d the difference, we can write: $d = R' - R'' = r' - r''$. The error is demonstrably inversely proportional to the base. From Fig. 1 we can then write $r'/r'' = (B + b)/b$. Substituting the value of r', thus obtained, in the equation $d = r' - r''$, will give $r'' = d/(B/b)$.

The computation is then simple, and the solution is rigorous, except for observational errors. Commander Parker's examples, worked thus are as follows:

	B	4.583 yards	log 0.6611499
	b	1.6404 yards	log 0.2149498
	B/b	2.7938	log 0.4462001
* B/b + 1 =	N	= 3.7983	log 0.5790744
	N		log 0.5790744*
	S	715.5	log 2.8546096*
	R″	2714.5	log 3.4336840*
	R′	2765	
	d	50.5	log 1.7032914
	B/b		log 0.4462001
	r″	18.08	log 1.2570913
	R″	2714.5	
	R	2696.42	
	R′	2765	
	r′	68.6	
	N		log 0.5790744*
	S	1575.0	log 3.1972806*
	R″	5975.3	log 3.7763550*
	R′	6240	
	d	264.7	log 2.4227539
	B/b		log. 0.4462001
	r″	94.75	log 1.9765538
	R″	5975.3	
	R	5880.6	
	R′	6240	
	r′	359.4	

If the first formula is written $\log R'' = \log S + \log (B/b + 1)$, it is apparent that a slide rule can be constructed to solve for R''. A logarithmic scale of ranges S sliding against a logarithmic scale of ranges R'', positioned by an index located for b and sliding against a logarithmic scale

of $B + b$ will give R'' direct from S. With such a rule, the parts of the solution above marked * can be omitted.

Furthermore, when a range can be taken on an object with a known base line, the slide rule makes it practicable to employ this stadimeter method for obtaining a range of greater accuracy than can be obtained using the range finder in the ordinary manner. It is important to note, however, that in any use of the method, an error in reading S is multiplied by $(B/b + 1)$ in R'', and affects the result in that proportion.

Ballistic Engineering Problems: Empirical Summaries

(See page 411, May, 1930, PROCEEDINGS)

C. G. WILLIAMS, *Chief Engineer, Green Bay Barker Machine & Tool Works.*—I wish to take exception to some of the statements made in that part of the article "Ballistic Engineering Problems," dealing with erosion rates and life of guns.

My remarks will apply principally to the following clause: "Immediately subsequent to the full engraving of the band, a displacement of a few inches at most, the gun tube begins to expand appreciably from the position of close contact with the engraving surface." In actual practice this cannot be true. The intense heat developed by the powder attains its maximum when the shell is less than one-half caliber past the ramp. The engraving on the band has been completed but the effect of inertia has caused the engraved slots to be prolonged somewhat, giving a slight stripping effect. This will leave an opening at the side of the rifling away from the contact pressure.

The expansion caused by the heat of explosion or combustion of the powder is not accompanied by an enlargement of the bore as Mr. Thompson would have us believe. Because of the restriction of the cold outer bands of metal, the expansion that accompanies the absorption of heat by the inner layers of steel composing the main tube is internal instead of external, from the fact that the outer rings of the metal are always colder than are the innermost rings. This condition is true from the first shot fired to the last one.

It is taken for granted that the condition to begin with is that which is the general condition of the gun before the first shot is fired; that the same practical condition exists between shots as existed prior to the first shot relative to the action of the metal in the gun toward the projectile; that as subsequent shots are fired the expansion is carried still further until such a time as the heat has been transmitted to the outer layer of the outermost band of the gun. From this time on, there is a possibility that the interior of the bore does expand slightly, but this would be a muted question for, as each shot was fired, the innermost rings of metal absorbing heat from the incandescent gases will be actually hotter than will each succeeding ring of metal to and including the outermost ring, each ring in succession being cooler than the next ring nearer the bore of the gun.

One of the attendant phenomena of this state of expansion is the deep cracks that in time invest the inner portion of the bore, especially that portion known as the cone and the ramp which, because of their positions in relation to the bore and their contour, are acted upon more severely by the incandescent powder gases than are the portions of the bore more remote from the powder chamber.

If there is any variation between the bore of the gun and the rotating band, as Mr. Thompson would have us believe, it is I believe fully compensated for by the expansion of the rear of the projectile and of the rotating band, which, being of copper, has a greater affinity for heat and greater conductivity of heat. Consequently the heat absorbed by the band will act upon the copper more severely than it will upon the interior layers of steel surrounding the bore and have a tendency to keep the bore sealed up by the band, excepting that portion opened up by the shear of the metal composing the ring, caused by the inertia of the weight of metal in the projectile resisting the tortional effect of the rifling. It is through these orifices that some of the gases that are always to be found ahead of the projectile escape. However, it is believed that by far the greater amount of the gases found ahead of the projectile come there through other means than through this orifice. This gas ahead of the projectile, added to which will be fresh gas that escapes past the stripped sections of the band, will assist the erosive action at the muzzle by giving up of its heat as it passes along

the bore. This gas is not free to move as it has considerable pressure imposed upon it by the action of the air that fills the bore of the gun before the powder is ignited. An attempt could be made to compute this pressure by the formula of moving gases.

In any gun, from the mountain howitzer to the heaviest coast artillery, after several shots have been fired there will be found innumerable small hair-line cracks extending up the surface of the steel parallel to the axis of the bore. These are caused by the internal expansion of the metal surrounding the bore crushing the crystals of the metal into a more dense structure and in a sense giving an effect of cold working on the metal. This expansion causes the metal to be worked past the elastic limit and a permanent set occurs in the innermost layers of the metal. If the metal is now allowed to cool, there is a reaction that is sufficiently intensive to disrupt the metal at many points, because the reaction will not be of such a nature as to be able to work the metal opposite to that work occasioned by it. As the contraction of the metal continues by the absorption of the heat both by the atmosphere within the barrel and by the outer layers of the steel, the metal will be strained past the elastic limit and cracks will appear. As the firing progresses this action is intensified until the hair cracks become deep dangerous fissures in the steel. These fissures gradually open up circumferentially as well as longitudinally, though the longitudinal fissures will always be found to be the more strongly developed. It is through these fissures that we see the greater portion of the gas ahead of and surrounding the projectile as it emerges from the bore.

Much of the wear or erosion to be found at the muzzle of the gun is occasioned by the rush of the heated gases through the orifice that is opened up after the rotating band has passed from the bore and the body of the projectile still extends within the bore.

It is believed that this action will be all the more violent in the modern gun with the modern boat-tailed projectile as a longer period of time will elapse between the clearing of the bore by the rotating band and the final clearing by the base of the projectile because, from the very nature of the contour of the base of the boat-tailed projectile, the rotating band is farther from the base than it was in the old square-base projectile. As this action continues, the point where the opening between the bore and the rotating band occurs will extend farther and farther up the bore from the muzzle with each succeeding shot, and as this point recedes from the muzzle, it is still further accentuated by the stream of gases that pour past the band after the clearance has been effected. Thus the effect is multiplied many fold as is intimated by Mr. Thompson, until all semblance of accuracy has been destroyed.

Many experiments have been carried on in the past to determine the erosive effect of incandescent powder gases passing through a small orifice but at this time no attempt will be made to derive a formula for this action or to give any value to a constant, denoting this effect.

PROFESSIONAL NOTES

JULY 2 TO AUGUST 1

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LIEUTENANT COMMANDER D. C. RAMSEY, U. S. NAVY
AND
PROFESSOR HENRY BLUESTONE, U. S. NAVAL ACADEMY

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UNITED STATES

The "V-5"

New York *Times*, July 27.—The submarine *V-5*, which made a trial trip at Provincetown, Me., is the safest submersible launched, according to a statement issued by the Westinghouse Electric and Manufacturing Company yesterday. The submarine made 17 knots on the trip. It will receive its final trials late in the fall. After the trials, the *V-5* will join Submarine Division Twenty at San Diego, Calif. It is in command of Lieutenant Commander John H. Brown, U. S. Navy.

The storage batteries of the craft are housed in a special compartment, so ventilated that no gases may escape into the vessel. In many submarine accidents, the influx of salt water into the batteries has generated chlorine gas and poisoned the crew. Other safety devices are "lungs" for every member of the crew. These enable them to breathe while rising from the submarine to the surface after any accident which may cause them to remain involuntarily submerged.

The *V-5* has three escape hatches, one through the coning tower and the others forward and aft of the torpedo room. They are so arranged that the entire crew may escape. Each hatch is built with a series of compartments or escape locks. In case of emergency, groups of the crew enter the locks with safety "lungs." The lock is flooded and they open the outside door and escape. Then the water is pumped from the compartment and the process is repeated until all are out.

For deep-sea diving and long under-water cruising, air-salvaging machinery has been installed, together with an elaborate ventilating system to insure pure air at all times.

In the control room are an automatic steering gear and a bank of valves that control all machinery on the ship. Between each bulkhead there is a complete set of automatic and manual controls that permit the vessel to be maneuvered from a number of places in cases of emergency. These controls also regulate the ventilating system, the diving and rising machinery and also the communication system, which is elaborate.

The propelling, flooding, ventilating, drainage, and other machinery, together with the hydraulic steering gear controls, ammunition hoist, and lighting sets were furnished by the Westinghouse organization. The *V-5* is unusually roomy. The craft is 371 feet long, 33 feet beam, and has a draft of 16 feet. The crew includes seven officers and eighty enlisted men.

To Test Diving Bell

Army and Navy Journal, July 12.—Tests of a modified diving bell will be undertaken during the first part of August at the Submarine Base, New London, Conn., by naval personnel attached to the experimental U.S.S. *S-4*, in order to further determine the practicability of rescuing men from a sunken submarine.

The modified diving bell is being completed at the New York Navy Yard, and its new features are the result of tests during the past winter off Key West, Fla., in which three types of diving bells were used in a series of tests with the *S-4*.

The tests to start in August will be conducted in still water at a depth of about 200 feet. After the preliminary tests, the new diving bell will be subjected, if satisfactory, to further tests under less favorable weather conditions to determine definitely its capabilities and limitations, as well as the precautions which must be taken in its use.

Should the modified diving bell prove successful in the tests, it is planned to construct a new and stronger bell capable of withstanding pressures at a depth of 400 feet, which represents the maximum depth for which submarines are designed to operate.

For the tests last winter which led to the development of the modified diving bell, three hatches on the *S-4* were provided with special coamings to which a diving bell could be attached in such a manner as to exclude the water and to permit passage between the submarine and diving bell. Three diving bells were provided for the Key West experiments.

One of the three diving bells was intended to be lowered from a surface vessel and centered over a submarine's hatch by means of hauling wires led to anchors planted around the submarine, the hauling wires being operated by a crew of three men in the diving bell. The second diving bell was intended to be hauled down to the submarine hatch with positive buoyancy by means

of winches from which cables were led to rings on the sides of the submarine hatch. The third type was a closed caisson which was intended to be hauled down by a winch on board the submarine and operated by her crew after a line from the winch had been attached to the caisson.

The comparative tests showed that the first type was the least satisfactory of all, since it was subjected to all the motion of the surface vessel from the action of the sea. The crew of the bell also had some difficulty in placing the bell accurately over the submarine hatch and in making the water-tight connection. The second type proved to have the most satisfactory means of lowering and attaching the bell for the reason that since it floated up from its wires, which were attached to the submarine, it was free of any considerable motion once it was well submerged. The third type was a closed caisson and its occupants were, therefore, not subjected to sea pressure as were the occupants of the other two types. No time, as a result, was required for decompression of the men rescued. The effort required by the crew of the submarine in hauling this third type down to the hatch was considerable, and in view of the probability that the submarine would be under greater than atmospheric pressure and that the crew might be in poor physical condition, this method of hauling down was discarded.

The tests at Key West, however, indicated that such a method of rescue offers some promise of success even under moderately adverse weather conditions, and so, the second of these three diving bells was sent to the New York Navy Yard, where a bulkhead is being placed in its bottom so as to avoid the necessity of placing the bell and its occupants under sea pressure while it is in use. This change requires other modifications in the arrangement of the winches and the method of attachment to the submarine, but its principle of operation will be substantially unchanged.

The tests of the modified diving bell to be undertaken at New London will be supervised by Lieutenant Commander Palmer H. Dunbar, U. S. Navy; Lieutenant Charles B. Momsen, U. S. Navy, and Lieutenant Norman S. Ives, U. S. Navy, commanding officer of the *S-4*. Most of the personnel who will conduct the tests have had long experience in submarines and are therefore the most concerned in determining the true value of any rescue apparatus. Some assisted in the salvaging of the *S-4* and the *S-51*, and are thoroughly experienced in the performance of work under water and under the most adverse conditions. All have been engaged in experimental work of this nature for nearly two years.

GREAT BRITAIN

H.M.S. "Keith"

Naval and Military Record, July 16.—From the Barrow works of Messrs. Vickers-Armstrongs, Ltd., the flotilla leader *Keith* was launched by Mrs. Jenkins (the wife of the Director of Navy Contracts) on Thursday. The vessel is a twin-screw ship constructed under the 1928 Admiralty program. Her principal dimensions are: Length over-all, 323 ft.; breadth, 32 ft. 3 ins.; depth to upper deck, 19 ft.

The ship is designed for service with destroyers of the *Beagle* class, and accommodation is provided for the senior officers of the flotilla. The armament consists of four 4.7-inch guns; two 2-pounder high angle pom-pom guns; four Lewis guns; one Vickers' machine gun, and eight 21-inch torpedo tubes arranged in two quadruple mountings.

The propelling machinery will consist of two sets of Parsons' turbines, with single reduction gearing, each set comprising one high-pressure and one low-pressure turbine, working in series, giving a total shaft horsepower of 34,000.

The condensers will be of the regenerative type, underslung from the low-pressure turbine casings.

Steam will be supplied by three Yarrow water-tube boilers, oil fired, fitted with superheaters and designed for a working pressure of 300 pounds per square inch and a superheat of 200 degrees F. All the auxiliaries are to be steam driven and the electrical requirements of the ship will be provided for by two 50-kw. turbo-driven and one 20-kw. Diesel-driven electric generating sets.

The 1930 Naval Program

The Engineer, July 27.—On Wednesday evening the First Lord of the Admiralty announced in the House of Commons details of the government's naval construction program for 1930. The vessels to be built

are three 6-inch gun cruisers of about 6,500 tons each, one leader and eight destroyers, three submarines, four sloops, one net layer, and one target-towing vessel. The ships, Mr. Alexander remarked, were required to replace others which were about to reach their age limit and were not being built with relation to the program of any other power. The program, he added, would involve a total expenditure of about £9,000,000 spread over three years. One cruiser, one submarine, and eight destroyers are to be built by contract.

Work at Singapore

Naval and Military Record, July 16.—Statements indicating progress made with construction of the Singapore Naval Base were made by the First Lord of the Admiralty on Wednesday, in the House of Commons in response to a question by Mr. George Lambert (Liberal, Southmolton).

Mr. Alexander said the total expenditure, including the floating dock, to the latest available date is £2,577,000. Estimated total expenditure is £8,721,000.

Contributions have been received by the Admiralty from the Dominions and Colonies to the extent of £1,672,000, the whole of which has been applied towards the naval expenditure incurred to date.

The date for completion of the main contract is September, 1935, and about two years further will be required for equipment of the base and completion of the machinery installation, making the final date for completion the end of 1937.

Mr. Lambert: "Is the base being constructed now at full blast?"

Mr. Alexander: "Nothing is being done at present except the main contract. All other work is in abeyance."

The "Excellent" Centenary

London *Times*, July 4.—About a century ago—on June 19, 1830, to be precise—Commander George Smith, R.N., was appointed by Admiralty minute as commander of the first ship to be set apart "for the practice of sea gunnery," H.M.S. *Excellent*. His appointment was nominally as supernumerary commander of the flagship at Portsmouth, but Admiral Sir Thomas Foley, the Commander in Chief, was informed that the commander "is only so appointed to give him his pay and time, but that he is to reside on board the *Excellent* in ordinary and to be charged with and employed exclusively in superintending an arrangement their lordships have decided upon for the practice of sea gunnery and for the instruction of the gunners and others belonging to the sea service desirous of availing themselves of it, at the port of Portsmouth."

It is of particular interest now to recall that this first scheme for gunnery training was on board a ship in the dockyard, an indication of the short ranges at which firing then took place. For many years, in fact, the *Excellent* lay off the north end of Portsmouth Dockyard. It was from these small beginnings that there developed the great Naval Gunnery School of today on Whale Island, in Portsmouth Harbor, the work at which has been so intimately connected with the enormous advances which have been made, not only in naval ordnance, but in everything appertaining to gunnery material and the use of naval armament.

At the time the school ship was started there had been hardly any change from the days of Trafalgar. Smooth-bore guns, flint locks, and truck carriages were still in use, and the drill was substantially the same as in the sailing line-of-battle ships during the eighteenth century. Responsibility for the material still lay with military and not with naval officers. Writing in 1825, Captain S. J. Pechell (later a member of the Admiralty Board) said:

> It is singular that the arming of a ship is the only part of her equipment which has not the superintendence of a naval officer. We have no sea officer at the ordnance to arrange and decide upon the proper equipment of ships of war; or to carry into effect any improvement which experience might suggest.

There is in existence a manuscript book entitled *Artillery Memorandums Relating to the Royal Navy*, by Captain Robert Lawson, Royal Regiment of Artillery, dated 1782, which was written for the purpose of the instruction of Prince William Henry (afterwards William IV), then a midshipman of the *Barfleur*. It contains such matters as the construction of sea ordnance, gun carriages, projectiles, and, in fact, all the appliances necessary at the time for artillery on board ship. This was the year of Rodney's victory at the Battle of the Saints, in which the advantages accruing from the

improvements initiated by Captain Sir Charles Douglas, the Captain of the Fleet on Rodney's Staff, were manifest and undisputed. Douglas was the father of General Sir Howard Douglas, whose famous treatise on naval gunnery, first published in 1820, had so much to do with the general advancement of the subject. Other improvements were brought about by Captain Philip Broke, of the *Shannon,* the gunnery of whose ship when she fought the *Chesapeake* was very highly organized.

In a time when there was no continuous service, and when ships picked up their crews as best they could, the existence of a school ship like the *Excellent,* from which parties of trained seaman gunners could be sent to the fleet at intervals, was manifestly a great step forward. It was Smith's initiative and enthusiasm which recommended him to the Lords of the Admiralty, and their decision was fully justified. One of his early steps was the production of a movable target for the men to aim at, whereby he became known in the service as "Target Smith." As certain disadvantages were found to attach to an officer of commander's rank employed on such work, Captain Sir Thomas Hastings formally commissioned the *Excellent* as an independent command in April, 1832. The first draft of seaman gunners were sent to the *Edinburgh,* 74-gun ship, in the following year.

Concurrently with the appointment of Captain Hastings, the gunnery ship was changed, and the *Boyne,* of 76 guns, a roomier vessel, was appropriated and renamed *Excellent.* She had been built to the plans of Nelson's *Victory,* and had been launched at Portsmouth in 1810. The original *Excellent* had been Collingwood's ship at the battle of St. Vincent and was his favorite command; she was broken up at Deptford in 1835. The second school ship of the name served until 1859, and from 1860 to 1892 there was another *Excellent,* which had been built in 1810 as the *Queen Charlotte* and which flew the flag of Lord Exmouth at the bombardment of Algiers. Later *Excellents* have been small craft, the work of the school having been carried out on shore since 1891.

Continuity in the work of the school was assisted by the retention of Captain Sir Thomas Hastings in command for thirteen years until 1845. Of other officers in charge in the early days, mention must be made of Captain H. D. Chads, 1845-54; Captain Sir Thomas Maitland, 1854-57; and Captain R. S. Hewlett, 1857-63, under whose régime the testing work and trials of appliances and armor plate were instituted in the *Thunderer* hulk. The whole science of gunnery had now undergone a complete change. Guns, powder, and fuses were all new. Small arms had been revolutionized. Increasing friction occurred between the Admiralty and War Office owing to the divided responsibility in regard to gun mountings, and in 1866 a solution was found by the appointment of Captain Astley Cooper-Key, who had been in command of the *Excellent* since 1863, as the first Director of Naval Ordnance. Later captains of the *Excellent* were Arthur Hood, later Lord Hood of Avalon, 1866-69, and Henry Boys, 1869-74, both of whom left to become Director of Naval Ordnance. An officer prominently concerned in the history of the *Excellent* was the late Lord Fisher. After being trained in her, he became gunnery lieutenant of the *Warrior* and returned as a staff officer in 1866, during which time he brought the gunnery manual up to date. After promotion and a commission in China he came again to the *Excellent* and supervised the start of the *Vernon* as a separate torpedo school ship. In 1883 he returned as Captain of the *Excellent,* and his assistants included some of the most valuable officers, the best known, so far as gunnery progress was concerned, being Lieutenant (later Admiral Sir) Percy Scott (see page 815).

The actual conversion of the two mud flats known as Whale Island (the name indicates their original appearance) into the great Naval Gunnery School of today, seventy-two acres in extent, was started about 1860, when the larger island of about ten acres was leveled and made into a rifle range. Later on development was facilitated by excavations in the dockyard, the soil extracted to make new basins being transferred by convict labor over a viaduct. By 1880 the two islands had been joined, and a resident gunner's cottage erected. In 1884 further buildings were provided, and in 1886 a start was made with the execution of a scheme to transfer the work of the school to the shore. In 1889, during the régime of Captain Compton Domvile, occupation of the men's new quarters was begun, and by 1891

all officers and men had been transferred and the hulk was given up. Officers' quarters and a causeway to the mainland were not provided until later. The visitor today, viewing the well-arranged barracks, batteries, parade grounds, gardens, and recreation facilities, may well marvel at the development of such handsome and congenial surroundings from a mud patch. They are in every way a fitting home for the principal gunnery school of the British Navy.

Torpedo-Boat Destroyers for Canadian Navy

Engineering, July 18.—The first of the two new destroyers *Saguenay* and *Skeena,* ordered for the Canadian Navy in January, 1929, was successfully launched from the Woolston Yard of Messrs. John I. Thornycroft and Company, Ltd., on Friday, July 11, the launching ceremony having been performed by Mrs. Desbarets, wife of the Deputy Minister of National Defense of Canada. The two vessels, which are due for delivery in the spring of next year, have a length of 309 ft. between perpendiculars, an over-all length of 321 ft., a breadth of 32 ft. 6 in., and a displacement of 1,320 tons, while their designed speed is 35 knots. They are intended to replace the *Champlain* (ex-*Torbay*) and the *Vancouver* (ex-*Toreador,*) which were transferred to the Canadian Navy in 1928 and are employed for training the personnel of the Canadian Naval Volunteer Reserve on Atlantic and Pacific Coast stations. It is understood that the *Saguenay* will be stationed at Halifax and the *Skeena* at Esquimalt.

In general design, the vessels are similar to the modified "A" type, *Acasta* class, destroyers of the British Navy, and, if required, they can operate with the destroyers of that class, which includes *Acasta, Achates, Acheron, Active, Antelope, Anthony, Ardent,* and *Arrow,* all of which were laid down in 1928 under the 1927-28 estimates. These vessels are 312 ft. in length between perpendiculars, 323 ft. in length over-all, and have a breadth of 32 ft. 3 in., with a displacement of 1,330 tons and a designed speed of 35 knots. They are propelled by single-reduction geared turbines driving twin screws and developing 34,000 shaft horsepower, steam being supplied at a pressure of 300 lb. per square inch by three water-tube boilers, oil-fired and fitted with superheaters. Their armament includes four 4.7-inch guns, two 2-pounder pom-poms, five machine guns, and eight 21-inch torpedo tubes on quadruple mounts.

The Canadian vessels, it will be seen, are of similar dimensions to the British vessels and will have the same speed and armament, but certain details of the design of the former have been modified to render them suitable for the more severe climatic conditions in which they will normally operate. It has been necessary, for instance, to provide heavier scantlings and to give sufficient stability to allow for the accumulation of ice on the upper decks, bridges, rigging, etc., and the climatic conditions have also necessitated the provision of an elaborate heating system in order to maintain a comfortable temperature in the living spaces with an external temperature below zero. In some other respects, the accommodation is differently arranged from, and on a rather more complete scale than, that usual on British destroyers, including such amenities for the crew as a recreation space and shower bath; more powerful motor boats are also carried. Many other special devices and arrangements have been incorporated in the vessels, either on the suggestion of the builders or the technical authorities of the Canadian Navy, so that considerable interest will attach to their service performance.

FRANCE

The "Albatross"

Naval and Military Record, July 2.—The 2,480-ton super-destroyer *Albatross,* which has just been launched at the Nantes Chantiers de la Loire in an advanced stage of completion, has a length of 129 meters, width 11 meters, draught 4.3 meters. The vessels are thus built on lines finer than the *Verdun* and are deeper in the water. They promise to be the fastest destroyers in the world, as their nominal boiler power has been raised from 64,000 horsepower to 70,000. The *Vauban,* sister-ship to the *Verdun,* has done 40.2 knots on trials against 39.85 for the *Valmy,* 38.45 for the *Guepard,* 40.2 for the *Verdun,* and 41.2 knots for the *Bison.*

Battleship Alterations

Naval and Military Record, July 2.—The 24,000-ton *Lorraine,* now in the Brest arsenal, is undergoing important internal al-

terations intended to improve her defensive capabilities, besides being converted to oil-burning with a view to giving her a sea speed of over 20 knots in addition to a much greater radius of action. An effort is being made to lighten her, only superstructures and fittings of essential fighting value being preserved. The *Bretagne,* sister-ship of the *Lorraine* and *Provence,* is to undergo, from next month, a similar transformation in the La Seyne Chantiers, near Toulon. These three battleships may be considered a French counterpart to the British *Iron Dukes;* they mount ten 13.4-inch guns, and their armor defense is very complete, their three armor decks having been strengthened with anti-bomb screens and partial internal caissons, making them proof against submarine explosions—on paper at least. They are, of course, much superior to the Italian *Duilios,* and their comprehensive refits give the French Navy a point of vantage.

It must not be forgotten that the Leygues shipbuilding program had been framed with a view to utilizing, for some ten years to come at least, the 24,000-ton ships forming the *escadre de combat (Bretagne, Provence, Lorraine, Paris, Jean Bart,* and *Courbet).* To that end these six ships have been modernized in conformity with the lessons of the war and have been protected both against air and underwater attacks. An overload has in some cases resulted from these comprehensive alterations. To do away with those surplus weights and to add a few knots to the speed is the policy officially pursued, although under the new conditions a few knots make less difference than formerly in the battle worth of pre-war *vaisseaux de combat.*

ITALY

Fiat Diesel Engines in Submarines

The Shipbuilder, July.—Admiral Sirianni, Minister of the Italian Navy, recently made a statement in the Italian Parliament, of which the following is a translation:

> Details regarding some submarine cruises are worth mentioning. For the first time in Italian naval history, submarines designed and built in Italy have made ocean cruises. I do not propose to describe these in detail, but shall confine myself to the most striking, viz., the latest cruises of the *Millelire* and the *Toti.* These two submarines each made a cruise lasting over two months, during which they made a non-stop run of fifteen days. At the end of this run, while south of the Cape Verde Islands, they submerged and remained submerged for thirty-six consecutive hours. The submarine *Millelire* covered no less than 18,000 miles in one year.

These submarines are each propelled by two Fiat Diesel engines, Type Q.458, developing a total of 4,400 brake horsepower at 380 r.p.m.

The Brazilian submarine *Humayta,* which was built in Italy to the same designs as the two Italian submarines mentioned, made the voyage from Italy to Brazil last year unescorted, and covered the distance of 5,000 miles from port to port without a single stop, thus breaking, we are informed, the world distance and speed records for submarines.

MERCHANT MARINE

The Training of Officers

Nautical Gazette, July 26.—In considering the general subject, "Training of Merchant Marine Officers," there are so many factors involved that we should agree as to the objective, and then lay a course that will bring us to that objective.

When the noun "officers" is used in connection with the merchant marine most people visualize a man or men in uniform standing on the bridge of a ship and others in uniform scurrying about on deck. For these I have no commission to speak, but the figures I shall give and the example cited are in substance equally applicable to deck as to engineer officers who comprise a part of and are often spoken of as the "black gang" who are seldom seen on deck and for whom I speak.

Now let us see where we stand with respect to ships and engineers. At the end of 1929 there were 1,911 steam and motor vessels of 1,000 tons and over in foreign and coastwise ocean service, and 92 of 500 to 999 tons, all requiring the services of approximately 7,920 engineer officers, and at that time there were available for this service some 20,868 licensed engineers, or about 2.63 men for each job. These figures are taken from government sources, and while arranged with special reference to engineers, apply fairly in the case of deck officers; therefore, it seems to me that if there be a problem with respect to training officers for the merchant marine it would have to do with future supply or replacements, and this

seems to bring us down to the real question, viz., the character and nationality of the unlicensed personnel on shipboard.

The best place to develop "officer material," concerning which and in some quarters we occasionally hear so much, is on shipboard.

Every licensed officer should be a sailor, as he is legally a seaman. The only place to make a sailor out of raw material is on shipboard.

The idea that "officer material" can be selected from a lot of samples submitted by parents, guardians or public officials ought to be abandoned; it is undemocratic, therefore unsound.

We have no quarrel with the selection of "officer material" for the Army, Navy, or Marine Corps. Young men who have had the advantage of four years' high school and in many cases two years' college, or their relative, choose a career in one or the other branch of the military service, and their status is fixed for life. Not so in the merchant marine.

As soon as the government selects from the school room or from any other source and trains "officer material" for placement on shipboard, the only incentive for young Americans to follow the sea is destroyed, except for this special or preferred class. Everyone agrees, in theory at least, that American ships should be manned by Americans, from the master to the boy on deck, and from the chief engineer to the wiper or coal passer. If we are honest in this belief the channels or opportunity for promotions should be kept open. Every boy who joins a ship should be made to feel that it is his right to aspire to the highest position on the ship.

Boys and young men start going to sea for one of two principal reasons, the need of self-support and an opportunity to ship, or from a spirit of adventure, a desire to see the world. They find the life hard, with living standards much lower than usually prevail on shore, in return for equal effort.

Nothing can take the place, in the every-day care of a ship, of experience. Supplement this as much as possible by special instruction or studies and in time you will develop the highest possible skill.

We hear much of I.W.W. ism, of sabotage, of unreliability of American crews, too much of which is true, and in my opinion this is in large part due to refusal of owners to recognize standard unions of seafarers.

If men, young and impressionable, and too often suffering under a sense of injustice, and enduring hardship, are denied the right to organize, and are thereby deprived of the advantage of collective representation, they naturally listen and finally fall victims to radicalism.

Having in mind that about 80 per cent of our merchant marine consists of cargo ships, I would seriously suggest to owners and managers the propriety of training cooks for their ships and forget about engineers and deck officers, of whom under present conditions, or under any likely to happen in the future, there is a decided surplus.

Some American steamship companies have in the very recent past built ships with the most modern equipment and developments in propelling units with pressures, and temperatures, and speeds, away beyond anything dreamed of twenty years ago. None of these companies found it necessary to go outside of their own organization for the brains and skill necessary to operate these units successfully.

We have seen the developments from the days of horizontal flue and tubular boilers set in brick with working pressures from 20 to some 400 pounds pressure, and in every step of this development marine engineers have successfully met the requirements of the service.

No plan or program in connection with the training of officers for the merchant marine by the government is justified that fails to take into account, first, the present surplus of licensed officers, both deck and engine; second, the very considerable number of young Americans now in daily training on ships in an effort to qualify for license.

We hear a great deal at times and from some quarters of the need of military training for merchant marine officers, presumably on the basis of national defense. The fact is, however, that for the purpose of national defense the services of these officers will be most needed and most useful for service on merchant vessels in their every-day capacity as supply ships, without an ample fleet of which no navy could remain long at sea.

Progress in Transportation of Oil by Sea

Marine Journal, July 15. By John L. Bogert.—At Scheveningen, Holland, on June 25, 1930, a notable meeting was held at which the Nautical Technical Institute, the shipbuilders and shipowners of the Netherlands and the mechanical and shipbuilding sections of the Royal Dutch Institution of Engineers were the host to the members of the Institute of Engineers and Shipbuilders in Scotland and the North-East Coast Institution of Engineers and Shipbuilders.

Mr. John McGovern, President-Elect of the North-East Coast Institution of Engineers and Shipbuilders, presented a paper for joint discussion entitled "Notes on the Progress in Transportation of Oil by Sea and Possible Future Developments."

The subject is one of peculiar interest to all shipping men, since the scepter over the domain of power generation at sea has undoubtedly passed for the time being from coal to oil, and the problem of its economical distribution to the ports of the world is second to no other in importance.

While quoting extensively from Mr. McGovern's paper we will be obliged to skip not a little of the historical part, interesting reading though it is. No summary can afford to omit the statement of the task Mr. McGovern set himself which is as follows:

The object of the paper is to give a résumé of the outstanding achievements in the design, construction and equipment of the modern tanker, and progress made in relation to the expansion of the petroleum industry. World petroleum production; history; expansion, with illustrated charts. Bulk-oil carrying vessels. Early types and developments traced to present day. References to strength and distribution of cargoes. Types of construction. Pumping, and other piping arrangements. Variations from orthodox types for special cargoes with illustrative examples. Anticipation of probable developments—Diesel v. steam. Increase in size. Increases in speed, with curves and diagrams illustrating them. Effect of new tanker freeboard if adopted. Average life of tanker. Corrosion, etc. Expansion of oil production illustrated with diagrams indicating concomitant tanker construction and possible developments.

So much of interest is packed into such a program, it is hard to know where to begin leaving out. Certainly not the opening passages.

The significance of the rapidly increasing demand made upon modern shipping to satisfy the transport requirements of the petroleum industry will be appreciated in realizing that it is responsible today for the existence of a fleet of oil tank vessels representing over ten million tons dead-weight carrying capacity, or over seven million gross tons, amounting approximately to 11 per cent of the total world tonnage.

One ton in every nine is a tanker!

The present era is that of "speed," and petroleum is the principal medium used directly or indirectly for the generation of power, and has been responsible for the remarkable advance in every department of transport on land, sea and in the air.

As the evolution of the modern tanker is the direct outcome of the petroleum industry, it is interesting to note that this industry came into existence about seventy years ago, although mineral oil or petroleum was then no new discovery. *Petroleum has been known by civilized man from the dawn of history.* (Italics ours.) Heroditus wrote of the springs of Zacynthus and the fountains of Hit have been described by the Arabs and the Persians. Mention is made of petroleum springs in China in the earliest records of that ancient people.

The first iron ship specially constructed to carry oil in bulk was the Tyne-built sailing ship, *Atlantic,* constructed in 1863. The first bulk-oil carrying steamer, the *Vaterland,* of 2,748 tons, was built at Palmers, in 1872, for the Red Star Company of Antwerp. She was essentially an ordinary cargo vessel, having her propelling machinery placed aft, and a complete inner skin about two feet from the ship's side fitted in her lower holds, the space inside the inner skin being subdivided into oil cargo tanks with independent trunks led up to the weather deck for expansion. Several similar ships, having inner skins, were built or converted about this time. The earliest vessels to carry oil right out to the skin of the ship were possibly those trading on the Caspian Sea and, in 1885, Mr. Henrick Riedemann, of Bremen, in collaboration with Messrs. Armstrong, constructed on the Tyne the *SS. Gluckauf,* a 300-foot ocean-going vessel, built on this principle and boiler-riveted throughout. This successful vessel may be regarded as the basis of the modern tanker with which we are familiar today. The independent expansion hatch, or trunk, to each compartment, except to bunkers, etc., gave way to the continuous expansion trunk either on the center of the ship above deck or at the sides below the upper deck, forming "summer" tanks, where additional oil could be carried when the draft was capable of being increased: hence the term "summer tank." The advantages of fitting the continuous expansion trunks were threefold; they improved the longitudinal strength, permitted considerable variation in safe loading with different cargoes, and improved stability by cutting down the free surface losses. (We think Mr. McGovern really means free surface areas, for it is the extent of free surface area with a liquid cargo which spells danger.) Incidentally, also, in the early vessels, the spaces at the sides of the expansion trunk were specially adapted for the carriage of bunker coal and later, when oil burning developed, for the carriage of oil fuel.

Another development was the fitting of cofferdams to isolate the oil cargo from the machinery

space and the fore part of a ship. These cofferdams subsequently became a government requirement for vessels navigating the Suez Canal. In certain vessels where different classes of oil cargo are carried, additional cofferdams and/or pump rooms are fitted effectually to isolate series of oil compartments.

In the early tankers, transverse bulkheads were frequently very widely spaced and severe damage and disaster due to the disruptive inertia effect of large bodies of liquid in motion often occurred. As a result of several investigations into strength and stability, a limit was set to the length of compartments with beneficial results to structure and considerable improvement in trimming arrangements to suit a satisfactory distribution of cargoes of different densities. In connection with the best distribution of cargoes, the provision of simple trimming diagrams, clearly indicating the most suitable disposition of varying cargoes and/or water ballast, is a matter of supreme importance to prevent ignorant loading of the structure far beyond its designed limits, as has so clearly been shown in several most useful papers recently given before the technical societies.

In connection with the loading of tankers, a feature not perhaps sufficiently appreciated is the amount of deflection which occurs in the structure under various conditions, varying in the case of the average tanker with machinery aft, from a considerable "sag" in the fully laden condition to an appreciable "hog" in the empty condition. The "sag" frequently amounts to as much as one inch per hundred feet of length, while the "hog" may possibly be about one-third to one-half of this figure.

The necessity of ensuring accuracy of workmanship in tanker construction so as to obtain perfect riveting is essential, and in some of the up-to-date shipbuilding plants at home and abroad, which specialize in tanker construction, the whole of the material composing the cargo tanks is drilled, greatly facilitating erection, fairing, and the elimination of drifting and rimering and ensuring the best possible riveting. Several of the continental builders today have adopted the practice in tanker construction of punching all holes a size smaller and when assembled reaming out all holes to the required diameter. The advent of electric welding is a factor which is destined to play an important part in insuring satisfactory oil-tight work and its increasing adoption in several parts of an oil vessel's structure is one of the modern developments in this class of work.

In the earliest bulk oil carrying vessels, the transverse system of framing in association with deep web frames, stringers and girders, was generally adopted. This was an adaption of the existing framing arrangement used in the ordinary cargo vessels, and continued until superseded by the longitudinal system patented in the year 1906 by Sir Joseph W. Isherwood, Bart., who realized the excess of transverse material in the existing tankers of the day, due to the close spacing of the bulkheads and the need for providing adequate longitudinal stiffening to resist the compressive and tensile stresses set up in the deck and bottom, respectively, in the sagging condition; also the necessity for making special provision for the peculiar nature of the oil cargo carried by the shell of such vessels. By the adoption of this system it was possible, by a scientific redistribution of the material, to obtain increased longitudinal strength with a considerable reduction in the weight of material. This resulted in an appreciable increase in the dead-weight carrying capacity for the same expenditure of steel-equivalent to eleven vessels, instead of ten built on the transverse method. These advantages were quickly appreciated with the result that the majority of tankers are constructed on this system.

Up to now 943 tankers have been built or are on order to be built according to the Isherwood system, totaling nearly nine million dead weight tons.

Quite a number of tankers are also constructed on a combination of transverse and longitudinal method of framing, the decks and bottom having longitudinal supports, and the shell sides being supported with transverse frames.

Lloyd's statistics for 1929-30 state that about 75 per cent of oil tanker tonnage was constructed on the longitudinal system, and it is interesting to note that the Isherwood system was adopted by *Lloyd's Register* in 1925-26 as the standard for their printed rules. The latest oil tanker development in hull construction is the patent "Bracketless" longtitudinal system designed by Sir Joseph W. Isherwood, Bart., in which the plate brackets connecting the longitudinals to the bulkheads are dispensed with, and long overlaps or doublings are fitted to maintain the longitudinal efficiency. Since the first vessel, *The British Inventor,* was built, in 1926, over 106 oil tankers, with a total deadweight carrying capacity of approaching 1,000,000 tons, have been constructed or ordered on this system.

With reference to hull design, the major portion of oil tankers today have the usual center-line bulkhead and summer tanks. There are several interesting departures which are worthy of passing reference. The treble tanker, which has two complete longitudinal oil-tight bulkheads extending over the whole range of the cargo compartments without summer tanks. This type is adopted today by owners for certain trades; it provides a good cargo distribution, and possesses several other advantages, including simplified erection facilities during building. The majority of this type have been built on the Continent.

In the case of tank vessels operating with cargoes of very volatile gas oils, where the evaporation losses are excessive, water-cooling arrangements on the exposed decks and sides above the water line are provided together with vapor condensing systems.

Recently, a rapidly growing fleet of specially designed vessels has been constructed for the carriage of molasses in bulk. The cargo compartments, owing to the heavy nature of molasses, are specially strengthened, and consist of long and short tanks alternately, the molasses being carried in the long tanks on the homeward voyage whilst water ballast is carried in the short tanks on the outward passage. Special heating and pumping arrangements are provided to deal with the heavy

cargo which has a specific gravity in the neighborhood of 1.4. The capacities of the long tanks are so arranged as to load the vessel to her load line with molasses and the capacities of long and short tanks and summer tanks are appropriate for carrying a benzine cargo, when loaded to the Plimsoll marks. Incidentally, the short tanks provide an ideal amount and distribution of water ballast.

Reference may also be made to the large vessels of the *Svealand, Amerikaland,* and *G. Harrison Smith* type, which are designed for dual service, carrying oil cargoes in one direction and ore in the other, the expansion trunks being at the sides of the vessel and forming the walls of the center ore cargo hold, the base of which is lifted well above the keel line to reduce the metacentric height when carrying ore and ensure easy movement in a sea way. Where such dual cargo requirements are definitely assured there would appear to be possibilities for the development of this type of vessel.

Although there are afloat at the present time quite a number of the earliest tankers thirty to forty years old, to some of which reference has already been made, a disturbing feature which is causing considerable concern to tanker owners is the early deterioration of the structure due to corrosion, which is becoming increasingly prevalent, *particularly in vessels carrying benzine* (italics ours) or oils containing sulphur or acids. This may, in part, be accounted for by the fact that refinery and distillation plants are becoming increasingly situated at or near the source of the oil supply and consequently a considerably greater volume of the refined products is now carried in place of the crude petroleum which previously formed the major proportion of sea transport. Cargo heating, steaming out, cleaning, and carriage of salt water on ballast trips, each contributes its share to corrosion, and unless the metallurgist or chemist can produce some more suitable steel or protective coating which will stand up to the adverse conditions met with on service, it would appear that the useful life of a tanker in certain trades may be said to be limited to perhaps ten to fifteen years. Several cases are on record where after twelve years' service or when the vessel is due for her No. 3 special survey, a seriously heavy reconditioning bill has had to be met to enable the vessel to retain her class, amounting to as much as 60 per cent of the original cost of the vessel.

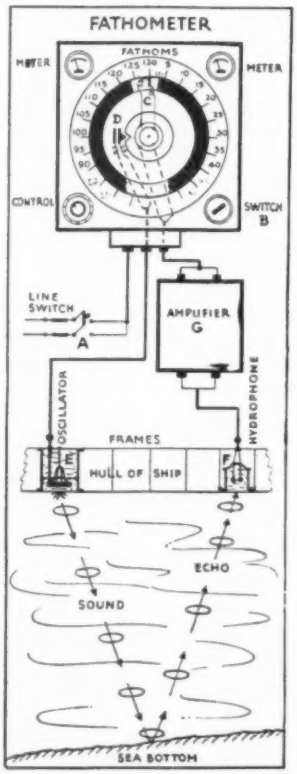
ENGINEERING AND RADIO

Sperry Stabilizing System

The Engineer, June 6.—The Sperry stabilizing system has now been fitted to a large number of vessels, mostly of the pleasure yacht class. An installation of particular interest is that supplied for the Japanese aircraft carrier *Hosho,* a vessel of about 10,000 tons displacement at full load. This ship has a metacentric height of 3.35 ft., and a period of roll of 12 sec. The gyroscopic equipment consists of a flywheel of forged steel 12 ft. 6 in. in diameter, weighing 62 tons and running at 815 r.p.m. The moment of inertia of the wheel is 2,834,000 in pounds and feet, and the centrifugal stress in its rim is about 13.5 tons per square inch. A turbo-generator of 185 kVA capacity supplies the alternating current used for driving the flywheel. The direct current for the precession motor is supplied by a generator of 110-kw. capacity. The total weight of the stabilizing equipment, including the electrical gear, is about 200 tons, or 2 per cent of the vessel's displacement. This particular equipment has been in service for about six years, and is stated to have given complete satisfaction. It is on record that when unstabilized vessels similar to the *Hosho* were rolling through a total amplitude of 40 degrees, the stabilized aircraft carrier showed simultaneously a maximum total amplitude of 2 degrees to 2.5 degrees.

Operation of the Fathometer

Submarine Sequal Company Pamphlet.—The fathometer indicator, shown in this diagram, consists essentially of a disc mounted on the end of a shaft and driven by a small constant-speed motor equipped



with a governor. The motor is started by closing the line switch *A* and turning the fathometer switch *B*. Mounted behind a radial slot in the disc is a neon tube *C*. In front of the disc is a circular scale which is graduated from 2 to 130 fathoms and lies just outside the path of the slot in front of the neon tube.

Sound Production.—A cam on the revolving shaft opens an electrical contact *D*, thus allowing the oscillator *E* to operate at the moment that the neon tube is at the top of the scale. The oscillator *E* produces a sound of short duration.

Sound Reception.—The sound echo returning from the sea bottom is "picked up" by the hydrophone *F* and a voltage is generated in the hydrophone circuit. This voltage is transmitted through the amplifier *G* causing a flash of light in the neon tube *C* which, by this time, has traveled part way around the fathometer dial. Acting like a luminous pointer, the flash of light indicates the depth at that instant. The disc to which the neon tube is mounted makes several revolutions per minute and light flashes of the neon tube, indicating depth, follow each other in rapid succession. If the bottom is level, the flashes will appear at the same point on the dial, but where the bottom is irregular it follows that they will vary in location in accordance with the contour of the bottom.

Stroboglow

Engineer and Engineering, July.—For the first time, apparatus so compact that it fits into a suitcase was demonstrated at Bettis Field, Pittsburgh, which made it possible to read marking on an airplane propeller revolving faster than 1,000 r.p.m. By means of this apparatus, called the stroboglow, propeller quiver and cracks and engine valve action are visible to the naked eye. Because of the importance of having the propeller and engine in perfect condition it is said to be probable that the stroboglow may be made part of an airplane's required inspection before flight.

The stroboglow, invented and developed by D. D. Knowles, L. R. Peters, and W. E. Bahles, of the Westinghouse Research Laboratories, makes moving objects appear motionless by means of flickering lights regulated to flash at intervals corresponding to the speed of the moving object.

Because of its compactness it can easily be taken to the moving object that engineers desire to observe. With it, the amount of slip of a belt moving on a pulley, the vibration of meshed gears in factory machines, and the movement of valves in gasoline engines may be observed. In short, anything that moves may be made to appear motionless.

The difference in revolutions per minute between motors, turbines, discs, or other units, revolving at approximately the same speed can be counted with the stroboglow.

The advantage the stroboglow has over previous instruments is its ability to be used on the job instead of trying to duplicate conditions in the laboratory. The only requirement for its operation is sufficient darkness to render the flickering lights visible on the moving object.

Low-Wave Sets Are Hazard on Ships

Coast Artillery Journal, July.—That short-wave or high-frequency transmitting apparatus installed aboard battleships and naval aircraft carrying explosives constitute a hazard was revealed in a report made by the Bureau of Engineering of the Navy Department. The report is the result of a test still to be completed and extending over a period of six months.

Investigations made aboard the battleship *Texas* by the bureau showed that it was possible to light an eighteen- to twenty-four-volt lamp by connecting it between the breech of a turret gun and the turret; to explode a primer in the breech by utilizing the energy; to light airplane running lights when exposed to the field of a short-wave antenna, and to set off aircraft flare primers when exposed to a high-frequency field.

As a result of the tests, Admiral Charles F. Hughes, Chief of Naval Operations, has ordered that "extraordinary safety precautions" be taken. He also ordered that no transmitters on shipboard shall be operated on frequencies above four thousand kilocycles during target practice, 75 mm. or below, when powder is out of magazines, when fueling ships.

The hazard is caused by a phenomena of short-wave or high-frequency transmission. It was stated that the hazard is negligible with apparatus operating on medium and long-wave lengths. Danger of spark has been eliminated by shielding and grounding

of all equipment within the field of a long-wave antenna. However, with short wave transmitters the energy is absorbed and carried by a metallic substance within the field of the radiator. As a result it has been recommended by Rear Admiral H. E. Yarnell, Chief of the Bureau of Engineering, that special precaution be taken in the installation of the apparatus, and that high-frequency antenna be located on shipboard at points far remote from resonant objects, such as guns and other equipment, which, when energized, constitute a hazard.

It is also urged that no radio apparatus having a power of more than fifty watts be employed aboard airships not inflated with helium, and particular attention should be paid to the bonding or connecting of metal parts in lighter-than-air craft.

Reconstruction of the "Darien" (formerly "La Marea")

The Shipbuilder, July.—Built on the Mersey in 1925, *La Marea* was a vessel 325 ft. in length, propelled by Diesel-electric machinery. It was decided to refit her with new machinery of greater power and to adopt turbo-electric plant. This required somewhat more space than the original machinery, and the problem was how to avoid encroaching upon the cargo-carrying space. It was decided to cut the vessel in two and to build in a new midship portion. This decision naturally evoked widespread interest, as cutting a ship in two and building in a new section is a very different proposition from that of constructing a new forward or stern part, as is occasionally done. *La Marea* was a special type of vessel with finer lines than an ordinary freighter; and the new structure, in addition to being blended into the old in the most satisfactory manner from a strength point of view, had also to be designed to give the most suitable form in conformity with the new dimensions and speed required.

As soon as the vessel arrived at Belfast, the original machinery was unshipped, the ship dry-docked, and the work of severing the hull taken in hand. The rivets in the shell, decks, tank top, etc., adjacent to the line of division of the hull, where necessary, were all removed. The top decks, deckhouses, and machinery casings were dealt with in a similar manner; and, in addition, it was necessary to cut away a good portion of the internal steel work to suit the new arrangements of the ship. The removal of other materials, apart from the steel work, also demanded particular attention, it being necessary to disturb a fair amount of deck planking and other deck coverings, pipes, etc., both for the severance of the hull and for access to the steel work.

After the complete severance of the ship, which was accomplished in about sixteen working days, the two portions of the hull were moved apart, and this very delicate operation was carried through most successfully and rapidly. The vessel at this time presented an extraordinary appearance, with a space of about thirty feet between the after and forward portions, and the ends of the different sections of plating projecting in zigzag fashion. Great care was exercised in keeping the two parts of the vessel in a perfectly upright position; and immediately they were settled in position, the work of building in the new structure was begun.

The fabricating of the parts of the new portion—frames, keel plate, center girder, intercostals, tank, shell and deck plating, deck beams, deckhouses, casing, etc.—was carried out in the usual manner followed in the construction of a new ship. This work vilian aviation experts opening on Monday.

AVIATION

Possible War Uses for Commercial Aircraft

New York *Times,* July 6.—By Clarence K. Streit. The possibility of quickly transforming big commercial airplanes into offensive weapons is not only greater than it was a few years ago, but is steadily and inevitably increasing, Brigadier General P. R. C. Groves declares in a paper on the relations of civil and military aviation which the League of Nations asked him to prepare for its international conference of civilian aviation experts opening on Monday.

The British general's thesis may be thus summarized: The needs of commercial aviation are forcing constructors constantly to increase the flying radius, safety, useful weight, and speed of big air liners. These are precisely the objectives which the constructors of bombing planes are seeking to achieve. Consequently, as air liners are de-

veloped, they are automatically becoming more and more capable of being used for bombing.

General Groves admits these air liners are not able to fly as high as is desirable for day bombing, but holds they are none the less useful for bombing at night or when visibility is poor and that they can easily be modified so as to enable them to fly higher for day work or do day bombing, as they would be under the protection of a convoy of pursuit planes. The general asks:

> Can one seriously deny that commercial airplanes such as the British Argosies and Handley-Page, the French Farman, Goliaths, and Jabrius; the German Junkers and Rohrbach three- or four-motored monoplanes and the American all-metal tri-motored Fords—to mention only a few types—can be transformed into extremely powerful night bombing planes?

General Groves estimates that the De Havilland Hercules used on the Cairo-Bagdad line, which has a speed of 130 miles an hour and a 17,000-foot ceiling, could carry two-thirds of a ton in bombs with a 500-mile radius. He estimates that the still more recent Fairey monoplane, which made a non-stop England to India flight, could drop a ton of bombs 1,200 miles from where it set out. He declares the British seaplanes of the Calcutta type, built especially for commercial purposes, are nevertheless superior for bombing to most seaplanes of the Royal Air Force.

None of the data necessary for such estimates, he points out, have been published on the huge German Dornier *Do-X*, but he says it is evident that this 12-motored 60-passenger giant has "a very considerable potential military value, for it can be used for bombing or chemical warfare."

On the other hand, General Groves holds that civilian planes are developing on such different lines from military ones, notably in being much less powered, that it is impossible to transform them into pursuit planes of any value in war. Though some of them can be used for auxiliary military purposes, he holds, even so their war value would not be up to the standard required.

The general's estimate of the military value of civilian aviation personnel follows:

Stressing the special value in aviation of experience, he declares that the pilots of the great commercial air lines, flying as they do regularly both day and night in all sorts of atmospheric conditions, have much more experience than "any other pilots." Thus the pilots of Imperial Airways, Ltd., average 100 flying hours monthly, while the ordinary Royal Air Force pilot does well to average 100 hours yearly. General Groves concludes:

> The pilot of the air line is incontestably an aviator of the first rank. His training makes him an excellent bombing pilot and he must consequently be counted among the first-line effectives.

He classes the mechanic of these air lines also as among the first-line effectives, as well as half the mechanics who are accustomed merely to small planes, the other half needing merely a short period of instruction to qualify. The pilots of small civilian planes, unaccustomed to powerful motors, he puts in the first war reserves.

How then to limit air armament without restricting the development of commercial aviation—the redoubtable question which will again come before the League's Preparatory Disarmament Commission when it meets in November. General Groves says the best thing to do is to face the aforementioned facts by including the big air liners and personnel in the nations' air armament so as to give the necessary base for a fair comparison. Moreover, if it were admitted that air liners are by their very nature bombing planes, General Groves believes, the result would be to stimulate commercial aviation by the nations—most of which now devote 95 per cent of their aviation appropriations to military planes and only 5 per cent to commercial aviation—subventioning the construction of air liners instead of bombing planes.

General Groves says it is now possible to classify the civilian planes of each country into those which can be used for offensive purposes, those which cannot be used offensive and those which can be used for non-offensive military and naval purposes. He urges this be done as the first step toward the limitation of air armaments.

To show the pressing need of such limitation he quotes the British Air Minister, Lord Thomson, to the effect that as early as 1926 a single continental power could drop on England in twenty-four hours all the bombs the Germans dropped there during the war and could keep it up daily thereafter—which would have meant air

fighting power already 1,500 times greater than during the war.

Moreover, General Groves says, since 1925, Italy has increased her air armament expenditures 28 per cent, France 92 per cent and the United States 126 per cent, while Britain has cut her expenditure 10 per cent.

Progress in Naval Aviation

New York *Herald Tribune,* July 16.—It is gratifying to note that naval aviation, which started out from scratch after the war, has received such consistent and intelligent treatment that by 1931 there is a fair chance that the five-year program calling for 1,000 planes in that year will have been achieved. Although the five-year program was authorized in 1926, appropriations were not forthcoming for its first year. Nevertheless at the close of the fiscal year 1930 the Navy had 928 "useful airplanes" on hand and 267 to order.

One thousand naval airplanes is not a large number for a country like ours. Moreover, the men in our naval air service have so distinguished themselves that the country need have no hesitation in giving them equipment adequate to their needs. The art of flying from floating landing fields, which the United States Navy has carried to a point of greater perfection than has any other country, deserves to be encouraged in every reasonable way.

As the able Assistant Secretary for Naval Aëronautics, Mr. Ingalls, has often pointed out, aviation is an art peculiarly suited to the genius of our people. In naval aviation we have already made such strides that to many persons the flying done from the aircraft carriers *Lexington* and *Saratoga* is as fine an example of the coördination of man and machine as our age affords. Under the London treaty we are allowed to put all our 6-inch-gun tonnage into aircraft carriers. There is much to be said for doing this, and there is everything to be said for starting work on the 10,000-ton carrier for which appropriations have already been granted. Most Americans would certainly see more value in the construction of these ships than in the present sterile debates on the naval treaty.

British Fog Flying Experiments

The Aëroplane, June 25.—A series of experiments in connection with the investigation of flying in fog have recently been made by the Royal Aircraft Establishment at Farnborough.

On June 18 a pilot of the R.A.F. flying a standard Avro aëroplane and carrying a member of the Air Ministry scientific research staff as a passenger, made a succession of five successful landings at Farnborough through a real fog which rose to height of 90 feet above the ground.

The apparatus used consisted of a small tethered sighting balloon 400 feet above the ground and about a half a mile from the aërodrome. The machine had a pitch and yaw indicator on the dashboard and a weight suspended by a wire a few feet below the landing carriage. The aëroplane left the ground for the first trial at 04.45 hours and flew through fog until it got into clear air above and then made use of the known height and position of the balloon to return to the aërodrome, gliding past the balloon at an angle indicated by the instruments and landing on the surface of the aërodrome by means of the indications given to the pilot by the lighting up of a red lamp on the dashboard when the suspended weight touched the ground.

The test was entirely successful and the pilot reported no difficulty. The machine took off again and the first trial was repeated. This also was successful. Three further trials were made.

From observations made from the top of the balloon shed at Farnborough note was made that when once the aëroplane disappeared from view in the top of the fog it was not seen again until after it had landed and taxied out into a clear area near the sheds. Though the clearer areas of the fog moved somewhat during the test the aircraft was not visible from the sheds at the moment of landing.

These experiments are considered to indicate a real advance in the technique of fog landing and the method should be of great practical use.

Regular readers of *The Aëroplane* will remember that the use of kite balloons and "landing-sticks" of the type used by flying boats in 1917 and later, was advocated in this paper for several years after civil aviation began in 1919, but the advocacy was abandoned some five years ago as any further pushing of the scientific people seemed waste of time and space. They are to be

congratulated on having re-discovered the idea.

New Variable Density Tunnel

The Aëroplane, June 25.—The National Physical Research Laboratory at Teddington will shortly be equipped with the new variable density tunnel which has just been built at the Sheffield works of John Brown and Co., Ltd.

The behavior of materials and sections at ultra-high speeds is still very much an unknown quantity, and the only practical way to reproduce these conditions seems to be in atmosphere of greatly increased density. To achieve high pressure in a space large enough to contain a wind tunnel and its equipment is a tremendous undertaking, but the National Advisory Committee for Aëronautics in the U.S.A. tackled the problem some ten years ago, and seven years ago were already discovering unsuspected facts about high-speed requirements.

Their first tunnel (which was actually invented and designed by a German aërodynamic engineer imported to America just after the war 1914-18) burst and caught fire, but another one has since been built. Today the feeling in America is that a high-pressure tunnel is of less use than a real high-speed tunnel. So after all we may be lagging behind with our latest scientific toy.

The new British tunnel, or rather its container, is 50 ft. long and has an internal diameter of 17 ft. It is built of four of the largest seamless rolled-steel rings ever made, and these are joined by encircling butt straps of tremendous size and strength. The hemispherical ends are made of steel castings, two each, which are joined by flanged and studded joints.

The container has been tested to 550 lbs. per square inch (or getting on for 40 atmospheres) and weighs 250 tons.

De Havilland Interceptor Fighter

Army, Navy, and Air Force Gazette, June 26.—The De Havilland Aircraft Company, Ltd., have in recent weeks designed and built a new type of interceptor fighter. It is a low-wing single-seated monoplane with many new features. It is fitted with an engine of 300 hp. which is also novel in its general outlay. In spite of the relatively low horsepower the speed of the new machine at 20,000 feet is 203 miles an hour. With the exception of one other machine fitted with an engine of double the horsepower, the De Havilland Interceptor is the fastest fighter at the service of the Royal Air Force. It is six miles an hour faster than the Fairey Firefly.

The accompanying photograph will give some idea of the general layout of the machine. There is a reversion to former aëronautical practice in that the entire tail-

THE DE HAVILLAND INTERCEPTOR FIGHTER

plane acts as the elevator. The principal dimensions are as follows: Span, 32 ft. 2 in.; length, 24 ft. 6 in.; height, 7 ft. 6 in. The total weight is 2,300 lbs. The wing structures are of wood and metal and the fuselage is of duralumin tubes with wooden formers.

The engine was designed by Major F. B. Halford and built by D. Napier and Son, Ltd. In front elevation it is in the form of an H with two banks of four cylinders each projecting upwards and another two banks projecting downwards. There are two crankshafts geared to the airscrew shaft. Unlike other Napier aëro engines the new type is air-cooled. The engine is narrow and, consequently, it is possible to give the pilot a good area of vision in front. It is supercharged and weighs 620 lbs.

French Air University

New York *Times*, July 20.—France's "University of the Air," said to be the first in the world, will start functioning next October, according to the Associated Press.

Fifty students will be chosen from a mass of applicants that already number 200. All aspects of aviation are to be considered in the many courses outlined for this government school to train air engineers for the future.

General Grard of the Air Ministry is to be head of the school. A ministerial decree shortly will make official the unofficial arrangements for the creation of the university.

For the first year the classes will be held in a private aviation training school founded twenty years ago. Eventually there will be school buildings and laboratories, a big air library, and an air museum, developed from the nucleus already housed in military barracks near Meudon. The new university is expected to be housed in the first of its own buildings for the second school year, beginning October, 1931.

Quite aside from the technical courses and laboratory research, the university is intended to be a center of world information on aviation. General Grard plans that every phase of aviation, from the study of materials for aircraft to the psychology of fliers and the weather shall be taught.

Navy's 1930 Air Record

New York *Herald Tribune*, July 27.—The Navy has just completed one of the most successful years in its history on "the new sea of the air," according to a comprehensive report covering the flying activities of Navy airmen for the fiscal year of 1930, which ended June 30. There were more hours of flying and more miles covered with fewer fatalities than in any year in the history of naval aviation.

The report revealed that the close of this year found the Navy's aëronautical establishment with 928 useful airplanes on hand and 267 on order.

During the year the total hours flown by Navy airmen were 203,000, with only one fatality for every 6,773 flying hours; and the hours of safe flying for every fatal crash were 11,289. The miles flown per fatal accident were 1,270,500 and the miles flown for each fatality were 1,015,000. Although there was a record increase in the amount of flying done by Navy pilots approximate increase of safety in aërial operation was 100 per cent over the previous year.

Rear Admiral William A. Moffett, Chief of the Bureau of Aëronautics, expressed satisfaction over the showing of the pilots and said that the marked increase in safety was to be expected and was due primarily to the skill of the naval pilots, their attention to duty, loyalty, and a complete understanding of the problems set before them; and, secondarily, to the "untiring and constant research, experimentation, and development in design of naval aircraft and naval aircraft accessories, to the end of lessening and eliminating the hazards of naval flying."

Admiral Moffett also stressed the thorough and painstaking methods employed at Pensacola in the training of naval aviators.

The new fiscal year is considered an important one in the upbuilding of the Navy's aërial forces, as it is the last appropriating year for the Navy's five-year aircraft building program. It is hoped that under the operations of this program the Navy will be in possession of 1,000 useful airplanes on June 30, 1931.

Future Air-Cooled Aëro Engine Development

Engineer, July 4.—By A. H. R. Fedden. It may be of interest to indicate some of

the most likely developments of this type of engine in the future. The author has deliberately narrowed the scope of his remarks to cover the near future only, as we are probably a long way from the standardized aircraft power unit, and the discovery of new materials may bring about radical changes resulting in an engine of a design outside our present conception, or the successful evolution of a type not at present considered as a prime mover for aircraft purposes. As aircraft differ greatly according to their purpose, engines will have to be designed for special purposes, and definitely divided into military and commercial types. For light commercial planes the in-line air-cooled engine has given exceptionally good service, and air cooling is universally used for this purpose.

It is believed that for some time to come these types of engine will hold the field. In America the 6-cylinder in-line air-cooled engine of similar power has been developed, and in inverted form it provides a new power unit with the minimum amount of resistance. For this category of aircraft several attempts have been made without success to produce an air-cooled two-stroke engine, with its obvious advantages of simplicity and light weight; with the introduction of supercharging and possibly direct fuel injection this may prove a likely line of development.

For commercial aircraft of moderate size and for training machines the air-cooled radial engine is very widely used in all countries. The Wright Whirlwind 9-cylinder 300-hp. radial engine is extensively used in four- and six-cabin passenger machines, and has been employed in transatlantic flights.

For military aircraft and commercial work the 400-500-hp. air-cooled radial aëro engine, such as the Armstrong-Siddeley Jaguar, the Bristol Jupiter, and the American Pratt and Whitney Wasp, are widely used.

Up to the present air-cooled in-line engines of this size have not been successful owing to cooling problems, and it is believed that by the time these engines are satisfactorily cooled by suitable air ducts the resistance will be practically the same as that of the radial engine, while the latter has the advantages of light weight and simplicity of construction outlined above.

During the last year or two the introduction of completely cowled radial air-cooled engines promises to mitigate the greatest objection to this type, namely, that the air flow in passing the engine cylinders becomes thoroughly disturbed. The desirable clean stream line flow is thereby considerably broken up, and as the disturbance continues past the structural part of the aircraft parasitic resistance is caused.

In the near future a 1,000-hp. air-cooled engine will be required for both military and commercial work, and it is believed that the compression ignition engine has a considerable future. So much has been promised for the compression ignition aëro engine of late years that there is some skepticism concerning it. For the smaller types of power unit referred to previously it certainly does not seem extremely hopeful, although compression ignition engines of 225 hp. are being produced in America. It would appear that to cope with the additional stresses of a compression ignition engine the specific weight will have to be at least 50 per cent higher than for the corresponding petrol engine, and for power units of 800 hp. or under this is a very serious consideration. There is also the question of smell, and creep from the fuel, and it is expected that this type of engine must run comparatively roughly, with serious effect on such a light structure as an aëroplane. When, however, one considers the requirements of a large aircraft remaining in the air for considerable periods, where the lower fuel consumption of approximately 25 per cent would be of the utmost value, it is believed that the compression ignition engine will come into its own. The author's firm have been experimenting for some time on a single-cylinder air-cooled compression ignition unit of 7⅜ in. by 12 in. and 512-cubic-inch capacity, and the results have been very promising. This single-cylinder unit has given an output of 80 b.hp. with a fuel consumption of 0.43 lb. per b.hp. hour.

The aëro engine manufacturer is always looking for better and lighter materials, and his developments must always depend on the materials available. Much is hoped from "nitralloy" steel, and from lighter non-ferrous forgings, such as magnesium, to prolong life and reduce weight.

Curtiss-Bleecker Helicopter

Curtiss-Wright *Review*, July.—The Curtiss-Bleecker machine (see p. xix August, 1930, PROCEEDINGS) consists essentially of four large wings or blades, mounted at right angles to one another and revolving in a horizontal plane. The wings are caused to revolve by propellers, one to each wing, mounted forward of the leading edge, about two-thirds of the way out; the propellers are driven through a gear-and-shaft arrangement from one central Wasp air-cooled engine, mounted horizontally. To each of the wings are attached outrigger booms mounting small elevators or tail surfaces. Thus, each unit is, in reality, a small airplane, consisting of a power-driven wing with a tail which can control the angle of incidence of the wing at any point.

Beneath the four wings is suspended a small fuselage in which are located the crew and which is equipped with a fairly conventional type of landing gear.

The Curtiss-Bleecker wings are made to revolve by the pull of their propellers. This design means that the Curtiss-Bleecker machine can rise vertically off the ground without any run and can hover indefinitely over any spot, performances which cannot be accomplished by the autogyro type of machine.

The development of the Curtiss-Bleecker helicopter has taken four years of intensive research and study in the Curtiss-Wright Engineering Laboratories under the direction of T. B. Wright, Chief Engineer, and Mr. Bleecker, inventor of the machine. The original principles of the helicopter were evolved by Mr. Bleecker while he was a student at the University of Michigan. Bleecker experimented with the design during his studies at Michigan and later, while he was employed in an engineering capacity at the National Advisory Committee for Aëronautics at Langley Field. In the early part of 1926, his original plans were submitted to the Curtiss Aëroplane & Motor Company and the company began its development. There followed a year and a half of research and wind tunnel testing to determine its flight possibilities.

Incidentally, immeasurable difficulties were encountered in making an intelligent engineering analysis of the problem. As an example, the hovering condition of flight, in which the machine remains stationary in the air over a given point, could not be simulated with the regular wind tunnel equipment and it was necessary to devise special methods and build special apparatus for this and a number of other tests of the machine.

As another example, the cooling of the engine operating in its rather unusual position, without the cooling effect of the usual propeller slip stream, presented difficulties and it was necessary to make a very thorough study of the problem of cooling and cowling design, which became a major problem in itself although really distinct from pure helicopter design.

Another year was spent in the detailed design of the machine and here, again, it was necessary to devise entirely new methods, particularly in making stress analyses for the unusual conditions encountered. All of this work was done under Mr. Bleecker's supervision.

Curtiss engineers will make no prediction as to the performance of the helicopter until flight trials in the near future are completed, beyond expressing their confidence that it will rise vertically, hover over a given spot, descend safely vertically, and move horizontally at reasonable speed.

This first machine has been designed primarily to meet these general requirements satisfactorily and has not been specifically designed to accentuate any particular feature of performance such as high speed, or rate of climb or load-carrying ability, as is done in design of present-day aircraft. Such specialization can be accomplished once the general principles of the machine are established as correct. The preliminary tests will be conducted over a period of several weeks and will consist of detailed check of the performance of every feature of the machine before actual flight trials are made.

Micarta Propellers for Aircraft

Engineers and Engineering, July.—The three micarta propellers whose whirling blades drew Major Kingsford-Smith and his crew in the giant transatlantic plane, *Southern Cross*, over the Atlantic Ocean from Ireland to Roosevelt Field, Long Island, were manufactured of a material made principally of cotton. These high-powered airplane propeller blades are made from ordinary canvas compressed into an incorrodible product of metallic strength which

greatly enhances the degree of safety in operation.

The announcement concerning the type of propellers used by Major Kingsford-Smith in his history-making flight was made by officials of the Westinghouse Electric and Manufacturing Company who developed the micarta propellers and who have been extremely interested during the past few weeks in this transatlantic hop.

Major Kingsford-Smith speaking of these propellers said:

> I have been using these propellers for eighteen months and they have proven themselves to be ideal for this venture. I have had the edges tipped with metal which has added greatly to their efficiency. I also had this same type of propeller on my hop from California to Australia two years ago.

The process of the manufacture of these propellers is a secret one, but it is commonly known that the basis of it is canvas, layers of which are impregnated with certain chemical components and pressed into a substance of steel-like hardness, and perfect moisture and water-proof resistance as a result of the application of the tremendous pressure exerted in the molding. These propellers when bronze or brass-tipped have been found especially adaptable for seaplanes because of their capacity to resist water spray.

This new type of propeller is said to represent the most advanced engineering practice in aviation. Besides having a high efficiency, each blade is a unit which is detachable from the hub. The popularity of the new-style replaceable blade, however, is based upon its superior efficiency and physical stability in the air.

Because of their exceptional resistance to moisture of any kind, these propellers prove especially successful in India and other tropical countries, as they have proven successful in the Philippines and the Canal Zone.

Fog Study as Aid to Aviators

Tycos, July.—With proper equipment, including airplanes for meteorological work at high altitudes, it should be possible to predict for a few hours in advance the exact vertical distribution of fogs, and to know also to what extent a fog will spread, according to Horace R. Byers, following a study of fogs for Daniel Guggenheim Fund for the Promotion of Aëronautics.

The Guggenheim Fund set up an experimental meteorological service, including a model airways weather reporting organization for the benefit of air lines operating between San Francisco or Oakland and Los Angeles. Thirty stations were located along the air courses. Meteorological observations are made at these stations simultaneously at 90-minute intervals during the morning, and once during the afternoon.

Mr. Byers reports that fogs are favored by a high-pressure area over the ocean leading to fresh north to west winds along the California coast, and an up-welling of cold water, and a consequent coolness of the temperature in central California. Added to these factors is the topography of the coast, high mountain ranges with few important gaps, causing a pronounced contrast between marine climate and the valley climate a few miles to the east.

In an explanation of why a condensation of moisture resulting in fog occurs, Byers declares that "the air over the ocean is no doubt approximately in a state of saturation before it comes in contact with the upwelled water of the California coast. Contained in this air are tiny salt particles which are to become a nuclei around which the fog droplets are to form. A continuous reduction of temperatures of the lowest layers of air until a minimum is reached near the coast is certain to cause condensation, provided there is sufficient movement to carry the process to completion."

> At first a haze is formed. Since the cooling is a surface phenomenon, it is to be expected that the fog is formed first on the immediate surface of the water, extending gradually upward as the reduction in temperature continues.

Among interesting temperature data collected during the research, is a chart showing that the inshore ocean temperature is lower at Cape Mendocino, north of San Francisco, during the summer, than at any other point even as far north as Cape Flattery and British Columbia. During August, the waters just north of San Francisco are four degrees colder than in the north Pacific. This is caused by prevailing winds and the up-welling of bottom waters, mentioned by Byers as one cause of fog.

MISCELLANEOUS

Deep-Sea Diving Record

London *Times,* July 2.—Two American scientists, working from Nonsuch Island,

have just penetrated in a steel sphere to a depth of 1,426 ft., or nearly five times as much as the previous low-depth record for diving with any kind of apparatus.

Dr. William Beebe, head of the Bermuda Oceanographic Expedition of the New York Zoölogical Society, and Mr. Otis Barton, of the American Museum, New York, were the explorers and were "battened down" in a steel sphere, with an internal diameter of fifty-seven inches and several inches thick, fitted with fused quartz observation windows, a telephone to communicate with the tug from which it was lowered, and equipment to keep the air pure—oxygen tanks for supply, and a quantity of sodium to interact with and render harmless the carbon dioxide exhaled.

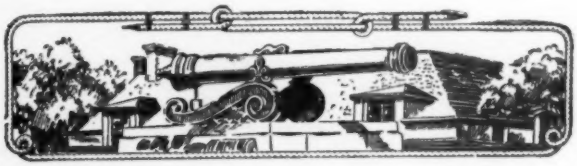
The weight of the sphere is 5,400 lbs., and as it was lowered in calm water five miles off the islands, where there are no known currents, either surface or submarine, there can be little or no doubt that it descended vertically in a straight line, and that the length of cable paid out represents the actual depth reached. The sphere was specially constructed in the United States to the order of Mr. Barton, who financed the experiment after working on the plan for over a year with Dr. Beebe.

When the two scientists had been made fast, the sphere was lowered at a fair speed from the deck of the tug into the water, which has a depth at this point of about 800 fathoms. A calibrated meter attached to the winch registered 1,426 ft. when Mr. Barton, who was in charge of the telephone, gave word to stop. A counter-check, obtained by marking off the cable in 100-ft. lengths, showed 1,428 ft., or an experimental error of less than 0.15 per cent.

At this depth the water above the sphere exerts a pressure of 652 lbs. to the square inch, or over forty-three atmospheres, and the actual weight of the water on the sphere would be about 3,100 tons. The sphere showed no sign of failing to withstand the terrific strain imposed upon it, and the men below reported that they felt no discomfort whatever. All that Mr. Barton said on the telephone was clearly heard on the deck of the tug by Miss Gloria Hollister, another member of Dr. Beebe's expedition, and readily taken down.

At this depth most of the light from the sun had been cut off by the intervening water, only the rays at the blue-violet end of the spectrum penetrating. At a depth of 1,000 meters, or a little more than twice the depth attained in this attempt, only the extreme violet rays persist, and between 1,000 and 1,700 meters all light rays are cut off. Dr. Beebe stated after his descent that the elimination of the middle and red end of the spectrum left an intense and seemingly brilliant blue light, quite strong enough for fairly easy observation of the fish that came past the windows but useless for reading the gages on the oxygen tanks, as it did not seem to reflect readily.

The fish that live at this depth are usually caught only on expeditions such as the famous voyage of the *Challenger,* and, more recently, the voyage of the steam yacht *Arcturus,* and although several thousands of them have been caught by the expedition at Nonsuch Island, Bermuda, in nets trailed from a tug at depths up to 800 fathoms, they are so unfamiliar that is was not found possible to identify them by a casual observation. The specimens that presented themselves most readily, however, all belonged to the extraordinary class which Dr. Beebe has been so successful in catching during his two years' work at Nonsuch—fish which carry their own lighting systems, built on an infinite variety of different patterns, but all depending on two organic chemical compounds, luciferin and luciferase, of which little is so far known.



NOTES ON INTERNATIONAL AFFAIRS

From July 4 to August 3

Prepared by Professor Allan Westcott, U. S. Naval Academy

RATIFICATION OF NAVAL TREATY

Senate Approves London Treaty.—The United States Senate ratified the London Naval Treaty on July 21 by a vote of fifty-eight to nine, after the bitterest treaty dispute since the rejection of the League Covenant. Of fourteen proposed reservations only one was adopted, the Norris resolution expressing the understanding of the Senate that the treaty was not affected by any extraneous agreements with the other treaty powers. The Senate rejected Senator David I. Walsh's resolution which would have committed it definitely to the policy of building up to the full treaty limits except in 6-inch gun cruisers.

In the long debate preceding ratification the chief event was the passing by a vote of fifty-three to four of the McKellar resolution which, as finally amended, merely requested the President to transmit all documents bearing on the negotiation of the treaty "if not incompatible with the public interest." The President in his reply repeated that the documents could not be given general publicity without breach of trust, but offered to reveal them in confidence to any senator who desired to see them.

British Ratification.—On July 24 the London Treaty was approved by the House of Commons without serious opposition and a week later was ratified by the House of Lords. Previous to this action First Lord of the Admiralty A. V. Alexander stated that all the dominions had signified their approval of the agreement. The Canadian parliament passed favorably on the treaty before its adjournment in early July.

Treaty Before Japanese Privy Council.—On July 24 the London Treaty was submitted to the Japanese Privy Council, which was expected to act favorably, despite stiff opposition from naval leaders. Prior to its submission to the Privy Council, the treaty was considered by the Supreme Military Council, which accepted a report of its naval committee to the effect that the naval strength allotted to Japan was "defective insofar as its national defense is concerned." This adverse comment was a victory for Admiral Kato, the new defense plans providing for only 70 per cent of the strength proposed by Admiral Kato when he was chief of Naval Staff. Admiral Takarabe, Minister of the Navy, and a strong advocate of the treaty, is expected to retire following its ratification.

Franco-Italian Naval Problems.—Foreign Minister Briand of France on July 10 announced that he had communicated to Italy an assurance that during the next six months France would undertake no new naval construction. He indicated that prospects were now more favorable for a settlement with Italy of both the naval problem and the political disputes over Tripoli and Tunisia. Italy reciprocated on July 14 with a similar promise to undertake no new construction, though as a matter of fact both French and Italian yards are fully occupied with construction already under way. Meantime Foreign Ministers Briand and Dino Grandi have each shifted to the other the blame for delay in taking up naval negotiations.

EUROPEAN POLITICS

GERMAN ELECTIONS IN SEPTEMBER.—President von Hindenburg dissolved the German Reichstag on July 18 following a defeat of the Bruening Cabinet in a vote which revoked the president's order permitting the cabinet to carry out its new finance and tax measures by government decree, without parliamentary sanction. Chancellor Bruening's cabinet will continue in office until after the parliamentary elections set for September 14 and the meeting of the new Reichstag in October. The present Reichstag, the fourth under the republic, was elected in 1928, and the Bruening ministry took office on April 1 of the present year as a government of the center parties dependent for a majority on support from the Right or Left.

FRENCH PARLIAMENT ADJOURNED.—On July 11 the French parliament was adjourned until November after a series of hot Radical and Socialist attacks on the government in the Chamber, such as have in fact characterized the session since last January. In a vote of confidence just before adjournment Premier Tardieu secured a majority of 316 to 268. In a subsequent speech the Premier sharply attacked present-day parliaments for their tendency toward reckless expenditure for local benefit, regardless of national economy.

STALIN DOMINATES COMMUNIST CONVENTION.—The sixteenth Communist party convention closed at Moscow on July 14 with a complete victory for Josef Stalin, who continues as general secretary of the party and supreme power in party councils. Following their complete recantation of views opposed to present government policy, the right wing leaders Tomsky and Bukarin were allowed to retain their seats in the Central Committee of the party, and Alexei Rykoff remained President of the Council of Commissars (equivalent to premier) with a place also in the party Politburo of ten members. This was explained as evidence of Stalin's ability to compromise, his need of support from these experienced politicians, and of the fact that the government policies have actually shifted toward the views advocated by these less radical leaders.

TURKS CRUSH KURD REVOLT.—The Kurdish tribesmen who since June 20 had been crossing the Turkish border from Persia and raiding villages in the Mount Ararat region were finally suppressed in July by Turkish troops. The Turkish government estimated the bandits to number over fifteen thousand, only a small part of whom escaped across the frontiers.

PAN-EUROPEAN PROPOSALS

REPLIES TO BRIAND NOTE.—During July practically all of the twenty-six European nations whom Foreign Minister Briand of France called upon for comment on his plan for a European union, sent in extended replies. In general these replies expressed willingness to take part in further discussion during the League Assembly in September, but poured cold water on the practicability of the plan. Both Italy and Germany urged that Soviet Russia and Turkey should be included in the proposed federation, and Italy also backed Germany in the view that rectification of injuries created by the post-war settlement must precede any progress toward economic coöperation.

The British reply published July 17 repeated the opinion expressed by most of the other countries that the European union must in no way weaken the authority of the League of Nations or its rôle in international affairs. The British note pointed out that the League was already active in nearly all of the problems which M. Briand had suggested as likely to be solved by a European union. Opposition to M. Briand's proposals came from supporters of the League, from those who suspected it as a plan for the aggrandizement of France, and from others who saw in it an economic coalition against America.

The Italian note, which advanced the most pungent criticisms of the plan, was summarized in the press as follows:

First, the principle that the sovereignty of states which are members of the union must be respected must be applied in the fullest manner, in such a way as to guarantee the rights of smaller nations, remove the last remaining demarcation between the victorious and vanquished peoples of the World War and favor conditions of absolute equality between all states.

Second, the federation of European

states must be coördinated with or subordinated to the League of Nations.

Third, membership in the union must not be limited to members of the League but open to all and therefore Russia and Turkey should be invited to collaborate in the elaboration of the projected union.

Fourth, great thought must be given to the constitutional problem of a federal European union in order to avoid the formation of continental groups in opposition to the European league, which would destroy the universal ideals for which the League of Nations stands.

Fifth, all members of the union must have a permanent place on the council, which would be the sole deliberative and executive organ.

Sixth, a European union must be preceded by a solution of the problem of the general reduction of armaments.

GREAT BRITAIN AND DOMINIONS

COMPROMISE MOVES IN INDIA.—Of chief interest in the Indian situation during July was the compromising tone of the speech of the Viceroy, Lord Irwin, at the opening of the Indian Legislative Assembly on July 9. The Viceroy repeated his carefully considered assurance that dominion status would be "the natural completion of India's constitutional growth," and declared that the Simon report, however valuable, would in no way impair the freedom of action of the October round table conference. Announcements made by leaders of various parties in India, following party conferences during the Assembly session, indicated a spirit of compromise and willingness to coöperate in the October meeting. With the approval of the Viceroy, two leaders of the moderate party held conferences with Mahatma Gandhi at the Poona jail, but there was no prospect of an immediate modification of the Nationalist campaign of boycott and civil disobedience. Export of cotton goods packages from England to India fell to 27,000 during April, May, and June of this year, as compared with 43,000 last year, while the total cotton export during these months was only 68,000 as compared with 91,000 the year before.

RIOTS IN EGYPT.—An anti-British and anti-government demonstration on the part of the Wafdist party in Alexandria, Egypt, on July 15 resulted in a clash with Egyptian police and troops in which seventeen were killed and about four hundred injured. Subsequent riots were almost equally serious. British forces in Egypt, totaling about twelve thousand, were not called upon in suppressing the disturbances. The British battleships *Ramillies* and *Queen Elizabeth* were ordered to Alexandria.

On July 22 King Fuad denied on grounds of unconstitutionality a petition signed by two-thirds of the members of both houses for an extraordinary session of parliament, but an unofficial meeting of parliament was held July 26, which adopted a motion of non-confidence in the Sidky ministry and inaugurated plans for a non-coöperative movement similar to that in India.

PALESTINE REPORT BLAMES BRITAIN.—The eighteen-day investigation by the League of Nations Mandates Commission of last summer's disturbances in Palestine ended with a report in which the British government was sharply blamed for failure to anticipate the disturbances and provide adequate forces to maintain order. Though hedging in its judgment in the dispute between Jews and Arabs, the report took a more critical attitude regarding the handling of the situation by the British authorities than did the previous report of the British Shaw Commission. In a statement in parliament, Lord Passfield, Colonial Secretary, declared that Jewish immigration to Palestine had not been actually suspended, though limited to the "absorptive capacity of the country."

The League Wailing Wall Commission ended its investigation on July 20 and returned to submit its report to the League Council.

ENGLAND SEEKS RIGHTS IN GREENLAND.—Press dispatches from Washington on July 18 repeated rumors that Great Britain was seeking to purchase Greenland in whole or in part from Denmark, or at least to extend its treaty rights, which at present permit British vessels to land and establish bases for fishing or similar purposes on the east coast. England's new interest in Greenland is chiefly in its bearing on a possible arctic air route from Canada to the British Isles via Greenland, Iceland, and the Faroe Islands, surveying and mapping of which is now under way by a British expedition.

The United States formerly had claims in northern Greenland based on Peary's explorations, but surrendered them at the time of the purchase from Denmark of the Virgin Islands. Transfer of any extensive territory in the Western Hemisphere has, however, a special interest to this country, especially in view of the policies enunciated in the Monroe Doctrine.

AMERICAN POLITICS

RED ACTIVITIES IN AMERICA.—Adjournment of Congress brought some publicity for the investigation of Communist activities in the United States by a congressional committee of which the chairman is Representative Hamilton Fish, Jr. Hearings during July were devoted chiefly to testimony bearing on the alleged political activities of Boris Skrvisky, head of the Soviet Information Bureau in Washington, and of the Amtorg Trading Corporation headed by Peter A. Bogdanov. Under examination Bogdanov revealed details of $80,000,000 credit for purchase of American goods, and made veiled threats of a rupture of Russo-American trade relations unless opposition ceased. These threats were repeated in Moscow by M. Litvinoff, who has succeeded Tchitcherin as Soviet Foreign Commissar or Minister of Foreign Affairs. As regards the value of Soviet trade, it was pointed out that Russian pulp wood and manganese had already been barred entry into the United States as products of forced or convict labor. A movement was launched by the Wage Earners' Protective Conference, formed from unions with a membership of 500,000 workers, for a complete embargo on Soviet exports to this country.

CONSERVATIVES WIN CANADIAN ELECTIONS.—The Canadian Parliamentary elections held on July 28 resulted in a sweeping Conservative victory over the present Liberal government. Four cabinet ministers were defeated. The tariff changes advocated by the Conservative party, it is estimated, will mean a $500,000,000 loss of trade to the United States. Of a total of 245 members in the Canadian lower house, the Conservatives elected 138, with two seats undecided.

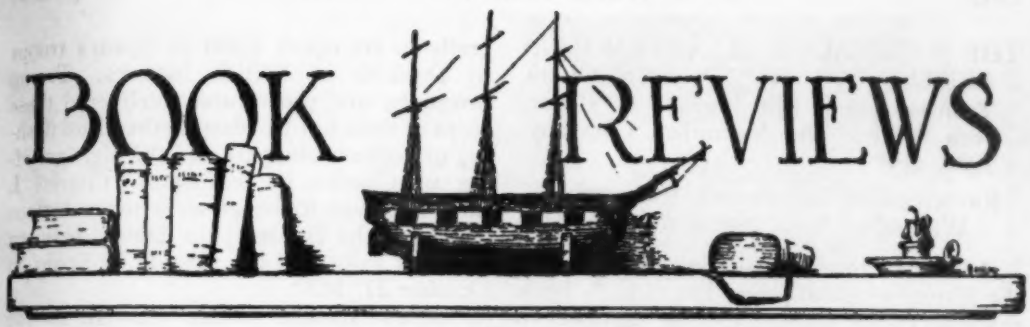
FAR EAST

REDS CAPTURE CHANGSHA.—While Nanking forces were withdrawn for the campaign in Shantung, "red" banditry captured and plundered the important city of Changsha, capital of Hunan province, on July 28. Foreigners were taken from the city in American, British, and Japanese gunboats which had come up the Siang River, a southern branch of the Yangtse. Nanshang in the neighboring province of Kiangsi was also reported to have yielded to red forces.

In the north, in Shantung and Honan provinces, the deadlock between Northern and Nationalist forces still continued during July, despite claims of military progress made by each side. Meantime the financial difficulties of the Nanking government became more acute, and practically all China south of the Yangtse was given over to banditry and political chaos. On July 30, Han Fu-Chu, Nanking commander in Shantung, quitted his forces and abandoned Eastern Shantung to the Northerners.

From New York "Times"

WAR-RIDDEN AREAS IN CHINA



BOOK DEPARTMENT

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PRINCIPLES OF STRATEGY. By Major General Sir F. Maurice. New York: Richard R. Smith, Inc. 1930. $3.00.

REVIEWED BY BROCKHOLST LIVINGSTON

There is nothing new in this. It has all been said by Clausewitz, by Foch, by Henderson, and by many others, for here what is new is not true, what is true is not new.

There can be no better quotation with which to sum up the theme of this volume. Strategy is unchanging. The principles of war are laws which time does not remold. It is only the *methods* of carrying on war which differ with each new meeting of the forces of Mars.

In the author's endeavor to expound a purely British strategy, he has impressed many old principles which bear rereading, but it is one point especially, that he has produced a valuable addition to the literature of war. "The correct coördination of policy and strategy," he writes, "is more than ever the key to the successful conduct of war." Wars have become not merely military actions, but national operations involving not alone the power of organized armies and navies, but the entire populations of nations. Coördination of objective and effort is, consequently, of the utmost importance to the successful conduct of war. History abounds with instances of the failure of policy and the military to concentrate on the same objective in war. General Maurice presents many examples to illustrate these failures of coöperation.

While the author ventures to suggest that statesmen are not always ably prepared to conduct their nation in time of war, he also states that the military populace is often equally ignorant of statecraft. How wise is the statesman who, when war must come, realizes the weight of Clausewitz's words that "war is not merely a political act, but also a real political instrument, a continuation of policy carried out by other means." But war fades into the past as an instrument of policy when every nation is striving to right wrongs by peaceful means. As the writer states: "There has, therefore, been a revulsion against the doctrine that war is the continuation of policy."

The author agrees that war is a political act, and yet questions if war will ever again be considered the continuation of policy in the sense in which the phrase was used in Germany. The principles of war do not change. Basic policies do not differ with time, but the means of engaging in war, and the causes for which wars will be fought change as history unfolds before us.

This latest product of the pen of so able a military writer as General Maurice is recognized to be, as he says, contains nothing new—so far as principles are concerned. However, it clears up many little differences which war must leave in its trail. The fairness of his exposition is one of the strongest points of his writing, and the book is one which may well be read by both the profession of arms and the followers of diplomacy.

THE JOURNAL OF MAARTEN HARPERTSZOON TROMP—ANNO 1639. Translated and edited by C. R. Boxer. New York: The Macmillan Company. 1930. $8.40.

REVIEWED BY INSTRUCTOR RICHARD S. WEST, JR., *U. S. Naval Academy*

A most interesting source document in the history of naval power has recently been made accessible to the public in the publication of the *Journal of Martin Tromp*. The section of the journal, which is translated and edited by C. R. Boxer, deals with the crucial year 1639, when Holland was completing the destruction of Spain's sea power. At this time the Dutch were revolting against the rule of the Cardinal-Infant Ferdinand, brother of Philip IV of Spain. They threatened to cast off the oppressive yoke of Spain, and Spain was compelled to furnish the Cardinal-Infant with men, money, and warlike supplies. Richelieu favored the Dutch in this contest; hence there was no route over which Philip IV might send supplies save by water.

As in the case of the earlier armada of 1588, Spain launched a grandiose array of ships. At La Coruña Philip caused to be assembled ships from almost all of Spain's chief maritime cities, in addition to squadrons from Dunkirk, Naples, and Portugal. As in 1588 a man was placed in supreme command who was primarily a general, and the result was a more humiliating defeat than that inflicted earlier by Drake, Hawkins, and the rest of the doughty seamen of Queen Elizabeth. More humiliating because this time there were no storms on which to lay the blame save the terrible artificial one created by Martin Tromp.

Tromp was a vigilant, careful seaman. He divided his ships into squadrons to patrol the North Sea and the Channel, to blockade Dunkirk, the Spanish base in Flanders, and to engage in scouting duty off the coast of Spain. Almost every day he sent one or more ships into port to be careened, frequent cleaning being good for both ships and men. He spoke to every ship passing in either direction through the Channel and kept an ever vigilant watch to prevent the arrival of Spain's Armada in Dunkirk.

This halting of ships proved embarrassing to Charles I of England. Some enterprizing English merchants attempted secretly to transport 2,000 of Spain's troops to Dunkirk in British bottoms. Tromp promptly, and prematurely, delivered these ships of their burden, despite the pistol flashing of cockney skippers and the high growling of Charles I's ministers. Charles I, however, was to be given a more serious affront in the Battle of the Downs between Tromp's ships and the armada of Spain on October 21, 1639.

Spain's armada finally arrived in the Channel on September 15. Tromp was cruising between Calais and Beachy Head with only thirteen sail. Immediately he sent a messenger to inform the other scouting forces. Witte de With managed to tack against a head wind and join his admiral just before the first engagement, off the coast of France. In this fight the Spanish used cavalry tactics, charged headlong into the Dutch with no thought for holding their advantageous windward position and with little regard for the effectiveness of their ships in the rear. Tromp gave De Oquendo's ship a severe battering. The Spaniards withdrew. Henceforth the initiative was exercised by Tromp.

A calm followed on the seventeenth and on the eighteenth Tromp renewed the fight. De Oquendo fled into the neutral waters of the English Downs for safety. Here the Spanish remained, temporizing, resorting to diplomatic bombast. Despite their huge number of ships they could do little else. The British Admiral Pennington placed his fleet between the two hostile parties to secure the peace. Tromp waited with a Dutchman's proverbial patience.

Then after he had replenished his ammunition and increased the number of his ships, on October 21 a fair breeze arose favorable for blowing the fire ships on the enemy. Tromp gave battle and all but completely annihilated Spain's power on the sea. Some few Dunkirkers who were skilled in navigating shallow coastal waters escaped to Dunkirk. Both the English King's fleet and his castles on shore fired on the Dutch for violating neutral waters, but they did him little damage.

The Battle of the Downs was significant in that Holland now became the chief naval power of the world. England before the end of the seventeenth century was to contend for this position in the three gigantic Anglo-Dutch wars.

Photograph by Chief Photographer Frank Shaver, U. S. Navy

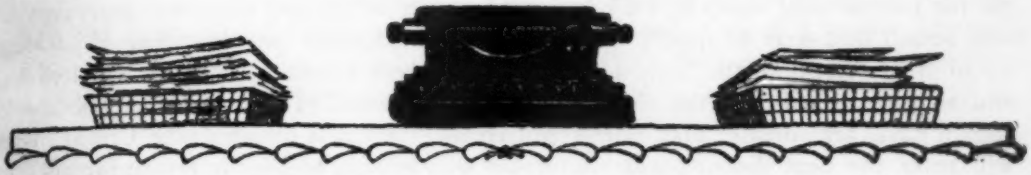
SAMPSON HALL, U. S. NAVAL ACADEMY

This wing of the academic group of buildings is named for Admiral Sampson and houses the Department of Electrical Engineering and Physics.

From the original by N. M. Miller at the Naval Academy

REAR ADMIRAL WILLIAM T. SAMPSON, U. S. NAVY
The tenth president of the U. S. Naval Institute, 1898-1902.

SECRETARY'S NOTES



Building program under the treaty Navy

The ratification of the London Naval Treaty by the Senate of the United States on July 21 is now a matter of historical record. Under its provisions, the completed tonnage for the United States in different classes of vessels which is not to be exceeded on December 31, 1936, is given in the following table:

Cruisers:	
(a) With guns of more than 6.1-inch (155-mm.) caliber	180,000 tons (182,880 metric tons)
(b) With guns of 6.1-inch (155-mm.) caliber or less	143,500 tons (145,796 metric tons)
Destroyers	150,000 tons (152,400 metric tons)
Submarines	52,700 tons (53,543 metric tons)

President Hoover has stated that the cost to the United States of replacements and new construction during the next six years, until the further conference, will be (under various estimates) from $550,000,000 to $650,000,000.

While the treaty was under discussion before the committees and again when it was before the Senate for ratification, there was constant speculation about the nature of the building program to be inaugurated under its provisions. From now on until the Congress takes appropriate action discussions may be expected to be more frequent and expressed opinions more divergent. It can be confidently stated that there will be at least three views about what the United States should do about its building program: the views of the extremist or pacifist, the views of conservative element, and the views of those who believe in a full-strength treaty Navy.

The group of extremists will contend, as in the past, that no ships should be built, that the United States does not need a large Navy, or one equal to that of any power, particularly the greatest naval power. They represent the class that will try to convince the public that the United States should show the less fortunate and smaller nations a reduction-by-example method. This, they will try to convince the people, indicates American leadership and idealism.

The conservative element evidently believe that parity between any two nations and particularly parity between the United States and Great Britain is impossible, due to the many and varied conditions which are involved. They believe that funds should not be expended on vessels where there is any chance of decided obsolescence by the time the treaty expires. They will undoubtedly advocate a building program under the advice of naval authorities to the end that types of ships may be carefully studied and improvements incorporated in pace with the times.

Those in favor of a full-strength treaty Navy will advocate a building program that

will insure full Navy strength in accordance with the terms of the treaty by 1936. They believe that the United States has assumed moral obligations and is in duty bound to maintain a Navy at full treaty strength; that the United States set an unprecedented example for international amity in 1921 by giving up its actual and conceded supremacy in new vessels that were scrapped; that by failing to discharge an obligation of building up to treaty strength, the United States will be given a lower position in naval circles, and as a result will lose the rôle of "beneficial dictator" of the cherished ambition to reduce naval armaments; that, unless full treaty strength is obtained, the United States will enter the next disarmament conference with nothing to offer in return for the concession of others.

No sound reasons have been advanced for the views of the pacifist. The reduction-by-example method during the past eight years has certainly afforded abundant disillusionment for this theory. Their proposals should be and will be rejected. The building program will be dictated by the conservative element or those in favor of a Navy of full treaty strength.

Noted anniversary

On August 5 the Coast Guard celebrated its 140th Anniversary. The Coast Guard was created on August 4, 1790, when President Washington signed an Act of the First Congress. It was originally called the Revenue Cutter Service, but became the Coast Guard when it was merged with the Life-Saving Service in 1915. The Coast Guard looks back on a glorious history from the time it served as the protection for the infant Republic's merchantmen after the Continental Navy had been dissolved. It has played an important and valorous part as a unit of the national defense in time of war and its peace-time activities have been of notable record. During the past year its 12,000 officers and men saved the lives of more than 6,000 persons and rescued or aided ships worth $50,000,000.

In its function of combating smugglers, a part of its duty is to make war on rum runners. Unfortunately for the service, this duty has at times brought publicity of a critical nature, that has overshadowed its more important activities.

Rear Admiral William Thomas Sampson

Rear Admiral William Thomas Sampson was the tenth president of the U. S. Naval Institute, 1898 to 1902. The frontispiece to the notes is from a painting by N. M. Miller. Sampson was born February 9, 1840, in Palmyra, New York; entered the Naval Academy in 1857; and was graduated in 1861, at the head of his class.

During a notable career he occupied the following important positions of trust: He was promoted to master in 1861 and to lieutenant in 1862; served throughout the Civil War in the Blockading Fleet, and was on board the monitor *Patapsco* when she was destroyed by a submarine mine in Charleston Harbor, in 1865. Commissioned lieutenant commander in 1866, and commander in 1874, his first command was the U.S.S. *Alert*, and next the *Swatara*. He was several times stationed at the Naval Academy as instructor or head of department and from 1886 to 1890 was superintendent of that institution. Sampson was in charge of the Naval Observatory in Washington from 1882 to 1884; in charge of the U. S. Torpedo Station, 1884 to 1886; a member of the Board of Fortifications and other Defenses, 1885 to 1886; and a delegate from the United States to the International Maritime Conference, 1887. Was promoted to captain in 1889, and the following year was assigned to command of the U.S.S. *San Francisco*. He

was in charge of the Washington Navy Yard and Gun Factory, 1892-93, from which duty he went to a four-years' tour as chief of the Bureau of Ordnance. In 1894 he served as a member of the International Prime Meridian and Time Conference. On leaving the Bureau of Ordnance in 1897 he went to command of the *Iowa*. At the outbreak of hostilities of the Spanish-American War he was appointed to the command of the North Atlantic Squadron. In September, 1898, Sampson was one of the three commissioners to Cuba. He was commissioned commodore in July, 1898, and rear admiral in March, 1899. In October, 1899, at his own request, he was detached from command of the fleet, and ordered as commandant of the Boston Navy Yard, which was the last duty he performed.

Mr. Park Benjamin, in his history of the Academy, in reference to Commander Sampson as Superintendent, says: "When Commander Sampson's tour of duty at the Naval Academy ended, there remained little for any one else to do, save to keep the standard of efficiency unimpaired."

Admiral Mahan, in his closing words at the dedication of the Sampson Memorial Window in the chapel of the United States Naval Academy on November 16, 1908, said: "The Navy appreciates him—the country will."

Importance of Merchant Marine

The industrial world has long recognized the importance of our over-sea trade, and to it has been given a clearer understanding of the importance of a merchant marine and a Navy in the development and maintenance of this trade. This year's wide-spread depression has probably brought home to many others how much our national prosperity is dependent upon foreign commerce. The agricultural communities particularly have reason to consider world conditions, and with this consideration may come a keener appreciation of the influence exerted by the merchant marine.

In his syndicated daily article on July 29, published in the *Washington Post*, and many another prominent daily, Calvin Coolidge says:

> Public interest in the merchant marine has never been sufficiently strong. We all believe in good roads on land. A merchant ship is the only good road on the water. For the same reason that the government builds highways and leaves them to private operation it is justified in helping build ships for private operation. Both national defense and commerce require ships.
>
> For the first time in years we are making some progress. Since the act of 1928 good rates are paid ship owners for carrying the mail in return for agreements to build ships for which the government lends money at low interest. Under this system we now have agreements to build sixty-eight ships aggregating about 700,000 gross tons and costing about $275,000,000.
>
> Because of this system we have reached second place among the nations in shipbuilding. But we are still far behind our needs. Our own vessels carry only about 40 per cent of our foreign trade. We are dependent on our competitors to carry 60 per cent of our trade to market. Of course the result is that they help themselves and hamper us. Parity in merchant ships is only less important than parity in warships. We ought to make the necessary sacrifices to secure it.

On July 31, the Baltimore *Evening Sun* closed an editorial by saying: "Yet Baltimore lives largely by reason of her water-borne commerce, and its steady increase is the main factor in the continued growth and prosperity of the city."

More and more the country is coming to appreciate that what is true of Baltimore is true of the nation.

PUBLICATIONS
U. S. NAVAL INSTITUTE

AVIATION

Aircraft Construction

Prepared under the direction of Lieutenant Commander F. P. Thomas, U. S. Navy. This book presents aircraft in its general features together with elements requisite to a fundamental understanding of the subject. 1929. 232 pages. $3.00.

Naval Aviation. Revised edition. New illustrations. 1929. 140 pages. $1.75 postpaid.

Airplanes, Airships, and Aircraft Engines.

By Lieut. Albert Tucker (CC), U. S. Navy. 1921. 436 pages. $3.50 postpaid.

ENGINEERING

Naval Auxiliary Machinery.

Compiled by officers of the Department of Engineering and Aeronautics at the Naval Academy, this book covers auxiliaries used in the naval service, which were previously treated in several textbooks. 1929. 152 pages; 11 folders; many illustrations. $3.50 postpaid.

Principals of the Basic Mechanisms.

Prepared for use of midshipmen by Lieut. Comdr. R. N. S. Baker (CC), U. S. Navy, and Associate Professor W. E. Farrell, U.S.N.A. 1926. 135 pages. $3.75 postpaid.

Engineering Materials and Processes.

Prepared as a textbook for midshipmen. Is the successor of Danforth's *Mechanical Processes.* By Lieut. Comdrs. G. B. Ashe and J. I. Hale (CC), U. S. Navy. Reprinted 1930 with slight changes and corrections. 267 pages. $2.50 postpaid.

Internal Combustion Engines.

By the Department of Engineering and Aeronautics, Naval Academy. Third revised edition. 1929. 326 pages. $3.40 postpaid.

Naval Reciprocating Engines.

Compiled by Lieut. Comdr. L. P. Bischoff, U. S. Navy. Some material has been taken from *Naval Reciprocating Engines and Auxiliary Machinery,* by Barton and Stickney, and new material added. 1929. 208 pages; many illustrations. $2.50 postpaid.

Marine and Naval Boilers.

Compiled by officers of the Department of Engineering and Aeronautics, Naval Academy, this text has been completely rewritten with the exception of Chapters VI and X. 1929. 194 pages; 16 folders; many illustrations and diagrams. $3.00 postpaid.

Naval Turbines.

By Commanders O. L. Cox and M. A. Libbey, U. S. Navy. Prepared primarily for use in the instruction of midshipmen. 1924. 241 pages with many illustrations and drawings. $5.00 postpaid.

LANGUAGES

French Nautical Phrase Book and Reader.

By Professor P. J. des Garennes, U.S.N.A. 1921. 181 pages. $1.50 postpaid.

A Spanish Nautical Phrase Book and Reader.

By Professor Arturo Fernandez, U.S.N.A. 1925. 175 pages. $2.00 postpaid.

Writing and Speaking: a Handbook for Naval Officers.

By Professor Carroll S. Alden, U.S.N.A. (This book replaces *Composition for Naval Officers.*) 1927. 359 pages. $2.50 postpaid.

LAW

International Law for Naval Officers.

By Comdr. C. C. Soule, U. S. Navy, and Lieut. Comdr. C. McCauley, U. S. Navy, 245 pages. Revised 1928 by Lieut. Comdr. C. J. Bright, U. S. Navy. $2.00 postpaid.

Constitutional Law.

Reprinted 1924 with slight additions. By H. J. Fenton, M.A., LL.D. 351 pages. $2.25 postpaid.